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THE PRACTITIONER.

JANUARY, 1908.

THE DIAGNOSIS OF GENERAL PARALYSIS.

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A CORRECT diagnosis of general paralysis in its early stages may be of very great importance, for momentous issues may arise, in relation to medico-legal questions, involving criminal responsibility, and testamentary validity. Moreover, social questions, relating to marital responsibilities and duties, professional and business capacity, may necessitate an unqualified opinion as to whether or no a patient is suffering from this fatal disease. To those, who believe, as I do, that, practically speaking, only those suffer from general paralysis, who have acquired, or inherited syphilis, it is always necessary to discuss the question of previous syphilitic infection in making a diagnosis. Now, because it cannot be proved by the history, or by residua on the body, that the patient has inherited, or acquired, syphilis, it must not be assumed that syphilis can be excluded. The whole of the facts must be considered in a question of this sort, and I propose therefore, before considering the signs and symptoms of general paralysis, its different types, and the differential diagnosis from other diseases, to discuss the relation of syphilis to this disease.

In Scandinavian countries, where syphilis has long been a notifiable disease, the causal connection between it and general paralysis has long been recognised; indeed, this connection was first pointed out by Esmarck and Jessen, and later by Kjelberg. But it was Fournier, whose vast experience gave him unusual opportunities of observing the later effect of syphilis, who first pointed out that tabes was a post-syphilitic disease, and, subsequently, he included general paralysis, adding that the two were so closely related to one another in their

ætiology that they might be regarded as one disease, which he termed parasyphilis. Fournier, having made this pronouncement, was at first violently opposed, but in nearly all countries the opinion has steadily gained ground that syphilis is, if not the essential cause, by far the most important cause of general paralysis.

Ert, Möbius, Mendel in Germany, Raymond and Regis in France, collected statistics, and strongly supported Fournier. Savage, so far as I know, was the first in England to call attention to the relationship of syphilis to general paralysis. Gowers has always advocated the syphilitic origin of tabes, likewise Ferrier. The last-named, in his valuable Lumleian lectures, advocates the syphilitic origin of both tabes and general paralysis, which he regards as one disease, affecting different parts of the nervous system. It was in British asylums that syphilis, as a cause of general paralysis, was not recognised ; in fact, the returns of syphilis, as a cause of insanity, were until recent years so few as to give the impression that syphilis had no causal relationship at all.

The work of Hirsch and Jadassohn showed that only in a little over 50 per cent. of the cases of general paralysis could signs of syphilitic residua, in the form of scar on the penis, or other signs on the body, be obtained ; and it is my experience that, in both tabes and general paralysis, the effects of the poison have usually been mild, often unobserved, and therefore untreated. In discussing various views as to why this happens, let me first call attention to the dictum of Kraft-Ebbing, that general paralysis is a product of civilisation and syphilisation. The opponents to this doctrine hold that there are numbers of cases of general paralysis in which there is neither a history nor sign on the body of syphilis ; how can it therefore be due to syphilis ? He answered the question thus :—I have taken nine cases of general paralysis, in which there is no history of syphilis, and in which there are no signs of syphilis on the body ; I have inoculated these nine individuals with the virus of a typical hard chancre, and watched these patients for 80 days. Not one of them showed any signs of primary sore or secondary symptoms ; the only conclusion to be derived was that they had inherited or acquired syphilis, and were therefore immune. Moreover, it may be inferred that they were immune, because

the cells of their body were producing anti-syphilitic bodies, and this explains why paralytics are rarely *if ever seen* suffering from a primary sore or secondary symptoms, in spite of the fact that, in the initial stage of the disease, a *hyperæsthesia sexualis* is a frequent symptom, causing promiscuous sexual intercourse, and liability to infection.

An argument has been advanced that a certain class of the population, who are more syphilised than others, do not especially suffer from general paralysis and tabes, namely, prostitutes; but Kron's observations show that there are more cases of tabes among prostitutes, if they are taken from a period of life when the disease commences, for it is between 35 and 45 especially that it first manifests itself; for obvious reasons, this is a period of life when prostitutes are not following their calling. Again, in many countries, where syphilis is very rife—Egypt, Abyssinia, Algeria—it has been said that tabes and general paralysis do not exist. This has been shown to be incorrect, and owing to imperfect knowledge and diagnosis. It is not likely that well-advanced cases of tabes and general paralysis would be so prevalent as in civilised countries, where more favourable conditions of environment would allow them to live longer. I have seen general paralysis in negroes, and in an Arab, who died at Claybury. In fact wherever syphilis exists, these parasyphilitic affections likewise occur; but it is in the highest degree probable that there is great force in Kraft-Ebbing's dictum that the conditions of civilisation tend to favour these late manifestations of neural decay as the result of syphilis.

There is no doubt that, comparing true syphilitic diseases of the brain and spinal cord, we find more often evidence of syphilitic residua on the body, and a more definite history of primary sore and secondary symptoms, than in general paralysis and tabes. These diseases, as Hitzig first pointed out, often follow what is termed a soft sore, and he came to the conclusion, as did Buzzard, that there may be several poisons which produce different effects, and Hitzig cited the analogy of diphtheria, in which, as is well known, a mild attack, often unrecognised, leads to post-diphtheritic paralysis. Recently, Max Löwenthal has advocated a somewhat similar explanation, except that he considers that the anti-toxin, which gives immunity in syphilis, produces an altered metabolism injurious

to the nervous structures. Many French neurologists and others have cited cases in which several people have been infected from the same source, and have later developed either syphilitic disease of the nervous system, or parasyphilis. It is possible that there is a special neurotoxic virus, and a remarkable instance in support of this has been afforded by Brosius, who relates an account of seven glass blowers, who suffered from chancre of the lip. He had the opportunity of seeing five of these ten years later; three had certainly developed tabes or general paralysis, and one probably so. This seems rather more than can be explained by coincidence; it may however be due to the fact that there are fewer lymphatic glands between the lip and the central nervous system than when infection occurs in the ordinary situation. Oppenheim, however, throws doubts upon the view that extra genital chancre is more liable to be followed by severe nervous disease. I have brought forward reasons for showing that the ætiology of tabes and that of general paralysis are practically identical; also that the period of time elapsing between infection and the commencement of symptoms, is identical; that numbers of cases begin with spinal symptoms, like ataxy, and end in general paralysis; that some cases begin with optic atrophy, and end in general paralysis; that cases begin with mania like general paralysis, and end in tabes. I have collected and described[1] over 70 cases of such, and there is no hard-and-fast line between the two diseases, clinically or pathologically. The most important objective sign of these para-syphilitic affections is the Argyll-Robertson pupil, the unequal pupils, and the pupil with either a transitory, or continuous irregular outline. These conditions (except the unequal pupils) are met with in no other diseases than syphilis and parasyphilis. Among those cases, I have described seven cases of husband and wife (conjugal paralysis), one suffering from tabes, the other from general paralysis. Such cases of conjugal paralysis are not common; seeing that three per cent. to five per cent. of syphilised persons subsequently develop paralysis or tabes, it follows that a certain number of husbands and wives must be affected, and the cases are not sufficiently numerous to show that there is a special neurotoxic virus, for we have to remember what a large number of male general paralytics

[1] *Tabes in Hospital and Asylums Practice, Archives of Neurology*, Vol. II.

there are, whose wives are in no way affected. Why it should affect the spinal cord in one individual, and the brain in another, is still a matter of speculation and polemical discussion. Edinger has brought forward strong arguments in favour of its being due to stress on particular systems of neurons, and he has endeavoured to show that the leg-weary postman, officer, engine driver, policeman, the women who work the sewing machine, are especially liable to locomotor ataxy. His opponents point to the hardy mountaineers of Bosnia and Herzgovina, who are racially syphilised, and who yet rarely, if ever, suffer from tabes.

Alcoholism, and the stimulating influence of a meat diet, have been adduced as causes of general paralysis, and some of the older generation of alienists still regard alcohol as an efficient and sole cause in some cases. I have now collected more than 40 cases of juvenile general paralysis; congenital syphilis could be determined in 80 per cent., and in the remainder it could not be excluded; but the existence of syphilis can very often only be determined by careful examination of brothers and sisters, by the history in the mothers of miscarriages and still-births, and by a careful examination and inquiry of both parents. It is remarkable how often one found absolutely no signs of syphilis on the body of a juvenile paralytic patient suffering from general paralysis, whereas brothers and sisters showed well-marked signs. A case, which recently came before my notice, is so instructive in this respect that I cannot refrain from briefly alluding to it.

A boy, aged 15, who showed no signs on his body indicating syphilis, died of general paralysis. I obtained the following history from the father, who had contracted syphilis five years before he was married, and was treated by eminent specialists, and was told he was perfectly safe in marrying. In the great majority of instances, this would have proved true, but, in this particular instance, it was disastrous. His first child lived but 12 hours, the second 2 days, the third was healthy, until between 9 and 10 years, when she developed keratitis, which, under the influence of grey powders, cleared up. Later, however, she developed nerve deafness, and the specialist, whom he consulted for this, said that, if he had continued the mercury treatment, she probably would not have become deaf.

Some of these cases, however, show well-marked signs of syphilis, for example :—

A boy, aged 9, attended the out-patient department at Charing Cross. He had had a fit at school; he had well-marked Hutchinson's teeth, rhagades round the mouth, an internal strabismus, and well-marked

choroido-retinitis. Still-births and miscarriages had preceded his birth, but the mother herself had never suffered. I lost sight of him for six years, when I found him dying of general paralysis in Colney Hatch Asylum. The fit he had was probably the onset of the disease. It usually begins at puberty, but, as in this case, it may begin much earlier.

I have noticed that a considerable number of these cases, quite 15 per cent., have occurred in patients whose fathers, and occasionally a mother, have died of general paralysis. Occasionally, father and son are in the asylum together. It is remarkable that the two sexes are about equally affected in the juvenile form, whereas, in the adult, males are affected practically in proportion to the greater incidence of syphilis in the male sex over the female. Thus we find general paralysis is common among the lowest classes of women, and decreases as we rise in the social scale; but, inasmuch as syphilis is common among every class of the community in the male sex, so are general paralysis and tabes met with in proportion relatively to the class and sex incidence of syphilis. It is rare among priests and Quakers; I have seen two cases in priests, both with a history of syphilitic infection. About 3 per cent. of the cases of general paralysis, dying in the asylums, are certainly due to congenital syphilis, and are of the juvenile kind. I recently saw an interesting case of a man, who died of general paralysis, when he was 28 years of age. He had no signs of syphilis on the body, but I found that his father had died at Claybury, about ten years before, of general paralysis. This patient had a fit when he was 18, and, from that time onwards, had shown some mental symptoms, but it was not till two or three years before he died that he became so bad that he was separated from his wife, and admitted to an asylum, where he died. The post-mortem examination revealed the most advanced degeneration of the brain characteristic of general paralysis; probably the fit, which he had at 18, marked the onset of the disease.

The fact that juvenile paralysis occurs as a result of congenital syphilis shows that the syphilitic poison can act in producing this degeneration apart from sexual excesses, alcoholism, mental stress, etc., and it indicates that, however powerful may be these influences in accelerating the onset and course of the disease in the adult, syphilis is the essential cause.

Now we may ask why, if syphilis is the essential cause, do not all syphilised persons develop these para-syphilitic affections? There can be no doubt that those conditions, which tend to cerebral or spinal neurasthenia, will tend, in a person infected with syphilis, to the development of general paralysis and tabes. It may then be said that juvenile general paralytics have not been subjected to these influences, but there can be no doubt that the syphilitic poison of itself will tend to nervous exhaustion, and, were it not for the fact that syphilis produces miscarriages, abortions, still-births, and deaths in early infancy, the number of juvenile paralytics and cases of other nervous diseases, functional and organic, due to congenital syphilis, would be infinitely more numerous than they are.

Why should the mild cases especially develop these para-syphilitic affections?

Kraft-Ebling's experiment, already referred to, indicates that they are throwing out anti-syphilitic bodies which gives them immunity. All the cells of the body are engaged in this operation. Now the cells of the nervous system, especially the brain, the most complete and differentiated in structure and function of all the cells of the body, are perpetual elements, incapable of regeneration, and, having once acquired the habit of throwing out these anti-toxins, they continue doing so all the rest of the life of the individual.

Thus they lose their durability, and the physiological margin of latent potential depending upon normal metabolism is thereby diminished, so that, if any stress occurs, destructive metabolism exceeds constructive, and decay sets in, and the decay is progressive and continuous.

This theory is rendered more than probable by the fact that Wassermann, Morgenroth, Plaut, Stertz, and others have shown the existence of anti-syphilitic bodies in the cerebro-spinal fluid withdrawn from cases of tabes and general paralysis.

Some authorities, Lessar, Bose, Hirschl, and others, hold that general paralysis and tabes are not parasyphilitic affections, but attenuated quaternary syphilis, and maintain that the lesion does not essentially differ from syphilis. Certainly there is proliferation of lymphocytes and plasma cells, and a

tendency to connective tissue formation in all forms of syphilis and parasyphilis.

Polymorpho-nuclear infiltration is not met with, unless there is secondary microbial infection. The fact that syphilis is due to the spirochæta pallida, which Schaudinn looked upon as a modified trypanosome, and that chronic trypanosome infections, such as sleeping sickness and the mal-de-coït or dourine of horses, produce a lymphitis of the central nervous system affecting the membranes and the perivascular spaces, closely resembling in many ways diffuse syphilitic meningo-encephalitis, general paralysis, and tabes, is of great interest. Moreover, how this lymphocyte and plasma cell infiltration, which is characteristic of all these diseases, is produced is not known. Possibly, both the trypanosome, and the spirochæta may undergo some modifications, and form an intra-cellular resting stage, which, at a favourable moment, owing to depression of vitality of the tissues, commences to multiply and proliferate.

This seems possible in the case of the gumma, as we know that a syphilitic person, even 20 years after the primary infection, may, in consequence of an injury, develop a neoplastic formation, and this structurally shows essentially the same fixed cell hyperplasia as met with in the primary sore and secondary eruptions, which are due to the presence of the spirochæta in the lymph spaces and channels of the tissues. The protozoal origin of syphilis may, in the future, lead to a change of opinion in regard to these (so-called) parasyphilitic affections.

Having thus briefly sketched some of the more important facts relating to the syphilitic origin of general paralysis, we are prepared to recognise that, in making a diagnosis, the absolute exclusion of syphilis, either acquired or hereditary, would enable us to practically exclude the possibility of the case being general paralysis or tabes, but cases will arise, very occasionally, in which *we believe* we can exclude syphilis with almost certainty. I have met a few cases myself, but, subsequently, I have either been able to prove the possibility of syphilitic infection, or have had doubts whether syphilis could be excluded. It may be remarked that Crocker could obtain a history of infection in only 80 per cent. of well-marked syphilitic skin diseases.

A well-marked case of general paralysis, with grandiose delusions, with unequal, irregular pupils, either reacting sluggishly to light, or altogether inactive to light, and active to accommodation, with tremor in the tongue and face muscles, tremulous, slurred speech, tremulous writing with syllables left out, and in thought, speech, and writing, a shedding of the higher functions of the mind apparent, a shuffling gait, with exaggerated knee-jerks, is a clinical picture which the student has put before him as the typical general paralytic, which even the educated layman is able to recognise; but it is not in such cases that there is difficulty in diagnosis; it is in the early prodromal stages of the disease, in the atypical cases, the juvenile cases, cases complicated with other diseases, cases complicated by alcoholism, lead, arterio-sclerosis, and syphilitic brain disease; but especially is it difficult to decide whether a case is one of neurasthenia, or the prodromal stage of general paralysis; for it is the neurasthenic, the subject of syphilis, who is especially liable to develop general paralysis.

Again, certain cases of chronic alcoholism may closely simulate general paralysis, so that they are often termed pseudo-paralysis; or the acute hallucinosis and paranoidal forms of alcoholic insanity may erroneously be mistaken for early general paralysis. Sometimes *mania â potu* may so closely simulate the mania of general paralysis that it is impossible to decide, until the patient has been kept under observation, and alcohol withheld. It may generally be said that a patient admitted to the asylum with *mania â potu*, in which the mania does not clear up after a month, will turn out to be a general paralytic, and it must be remembered that an early sign of this disease is often a lapse from moderation to intemperance. Thus, when admitted, he will have a history and signs of alcoholic intemperance.

In considering the diagnosis of general paralysis, it must be remembered that the great majority of cases commence in the fourth and fifth decades of life; that it is much commoner in males than females; that there are different forms of the disease; and that there are certain objective signs present. The term paralysis is incorrect, for it is a paresis; and a gross paralytic condition points away from general paralysis rather than to it. It is a progressive failure of the fine motor

adjustment of the brain affecting the instruments of the mind, the speech, and the hand, by which individuals express their thoughts and emotions, rather than the coarse paralysis of limbs. This we can understand when we remember that the disease is a shedding of the highest, and latest acquired functions of the mind, the cerebral cortex; and as this process goes on, and in proportion to the destruction of the cortical elements, so there is a progressive dementia, which, of all the symptoms of the disease, is the most constant. Inasmuch as there are no coarse paralyses, as in syphilitic brain disease, there is rarely any gross pyramidal tract degeneration in the cord. Consequently, although the knee-jerks, in the majority of cases, are exaggerated, we do not obtain ankle clonus, or Babinsky's, or Oppenheim's signs. The muscles, although they may be wasted, all respond normally to electrical stimulation. In spinal cases, that is the tabic form, or cases which have begun with locomotor ataxy, and ended with general paralysis, the knee-jerks may be absent on both sides, or absent on one side and present on the other. There may be, in such cases, sensory disturbances as in tabes, and these sensory disturbances may give rise to delusions of electricity, poisoning, etc. Again, visual hallucinations may occur, especially where there is commencing optic atrophy. In the prodromal stage of general paralysis, the only noteworthy symptoms are those which the nearest relative, the wife, members of the family, or the partner in profession or business may have noticed in the conduct of the patient. His moral and æsthetic feelings may have changed; his character, previously cheerful and gay, may have become irritable, morose, depressed, and changeable in mood; perhaps apprehensive and filled with morbid fears and dread; or previously quiet, careful of his money, a good husband, and a good father, he becomes neglectful of his home, and wrapped up in some scheme, by which he will satisfy newly acquired ambitious designs; or there may be marked exuberance of spirits, exhilaration, and a desire to spend money; or a hyperæsthesia sexualis, with an insufficient power to satisfy his impulses, will lead to strained marital relations, immorality, and promiscuous intercourse, exhibitionism, and even sexual perversions. The moral and æsthetic feelings of the man are changed.

Sometimes the first indication may be attacks of giddiness, resembling *migraine*, or convulsive seizures, with or without loss of consciousness, or a temporary loss of speech, and apparently the patient subsequently presents no other signs or symptoms of the serious brain affection of which these attacks may be the herald. Seeing that neurasthenia is frequent among the very class of people that suffer from general paralysis, namely, men who are ambitious, filled with ideas and active in profession or business, men who have lived fast, or shown much mental capacity, or quickness of mental reaction, suffering from brain-fatigue, they may take alcoholic stimulants or drugs such as morphia or cocaine; such men are likely either to have had syphilis, or to have been in the way of getting it, and are therefore the very individuals who are likely to develop general paralysis.

It naturally comes to the mind of the practitioner to think of the possibility of the prodromal stage of general paralysis, when such an individual comes to him, suffering from headache, lassitude, weakness of memory, loss of power of attention or of sustained mental effort, inability to find words to express his thoughts, hesitation in speech, tremor in tongue and lips, hypochondriacal ideas, a morbid dread of softening of the brain, from which he has heard that some friend of his, with similar symptoms, has suffered. The question arises, how are we to decide whether he is in the prodromal stage of general paralysis? It may be particularly difficult to do so if the case is complicated with alcoholism or drug-habit. The knee-jerks will probably be exaggerated in any case. If the friends (and more especially the wife) are unable to state that there is any change in his character other than depression, if there is no sign of dementia, and the only mental symptom the hypochondriacal tendency, it is probable that the patient is suffering from a neurasthenia.

The examination of the pupils, in such a case, may afford the most valuable objective sign. Inequality of the pupils would indicate organic brain disease, and the existence of a sluggish reaction to light, or the Argyll-Robertson pupil inactive to light while active to accommodation, would be certain evidence in favour of general paralysis. Still the pupils may not show any of these signs. Joffroy and

Schramek, also Piltz, and others, have recently shown the importance of the irregular pupil in the diagnosis of early cases of tabes and general paralysis, and this irregularity or contour may precede all other signs, and points to general paralysis, tabes, or syphilis. The irregularity may be continuously or only transitorily manifest, when the light reflex is tried. The pupil, instead of being circular, is irregularly angular, and, owing to the unequal tension of the muscular structures of the iris, it may be displaced from its central position, and become more or less eccentric. Should any of these pupil anomalies be present, a grave prognosis would be indicated.

Again, lumbar puncture is a most valuable means of determining whether or no a patient is suffering from functional or organic disease of the nervous system, for, if the cerebrospinal fluid withdrawn by this operation is centrifuged, and a deposit found, which, on microscopic examination, consists of lymphocytes and plasma cells, we can certainly exclude neurasthenia, hysteria, and other functional neuroses and psychoses. The existence of these cellular elements points to chronic organic disease of the central nervous system, notably tabes, general paralysis, syphilis, and tubercular meningitis. Consequently, all doubtful cases can be cleared up by this simple operation. The Wasserman-Plaut method of examining the fluid for anti-syphilitic bodies may prove a most useful adjunct in skilled hands.

Dementia præcox, or the primary dementia of adolescence, could thus, and by the absence of pupillary phenomena, be distinguished from juvenile general paralysis, with which it might possibly be confused, although the initial symptoms are really *not* like those of general paralysis, for they frequently begin with auditory hallucinations and delusions of a fragmentary character, without any evident dementia. There may be catatonic stupor, automatic obedience, and occasionally impulsive automatism, or the patient may gradually become imbecile and demented—the hebephrenic type. This type is the most likely to be mistaken for juvenile general paralysis. It is the primary dementia of adolescence of Clouston, but the pupil phenomena, characteristic of general paralysis, are absent in this disease, and although there is a blankness of expression,

or an "air de béatitude," yet the tremors of tongue and lips are not met with. It is an extraordinary thing, and of psychological interest to note that grandiose delusions are seldom met with in the juvenile form of general paralysis. There are two types (1) in which the child is an ament from birth; (2) the other, in which until puberty, the child may be of normal intellectual capacity, and then the degeneration process starts. The reason why juvenile general paralytics have not these grandiose delusions of wealth, ambition, and sexual vigour, is because, until puberty, these passions have not formed a part of their experiences of associative memory, whereas, in the adult, according to the character of the individual, the dominant passion of his existence may have been associated with one or more of these tendencies, and they have formed a large part of the routine habit of his thoughts and emotions. Consequently these experiences have become more deeply organised in his brain, so that, as the mind is shed by the process of decay in his brain, this passion is left uncontrolled and unantagonised, and rises accordingly into consciousness pathologically magnified. I had a striking example of this, exhibited to me in the following manner:—

A man, who had been an old-furniture dealer all his life, had the delusion that all the furniture in the asylum belonged to him and he talked nothing but furniture. He suffered from general paralysis, had a gumma of the tongue, for which half the tongue was removed on the supposition that it was an epithelioma, and he died a year later of general paralysis.

On visiting another asylum, I was shown a woman who had a tertiary syphilide on the skin, and who had the delusion that all the furniture in the building belonged to her. This immediately made me think of the name of the man, who had died at Claybury, I found that it was her husband.

It is of very great importance, from a therapeutical point of view, to discriminate between the various forms of brain syphilis and general paralysis, for the one is a neuronic decay, which cannot be influenced by anti-syphilitic treatment, whereas apparently hopeless cases of true brain syphilis may be either cured, partially cured, or greatly relieved by energetic treatment with mercury inunction and injection, and large doses of iodide. Many of these cases were generally wrongly called syphilitic general paralysis; they are quite different pathologically. Syphilitic brain disease is a specific neoplastic formation, occurring in the lymphatic structures of the mem-

branes, perivascular lymph spaces, and walls of the vessels, especially the arteries, tending to the formation of diffuse gummatous deposits spread over the surface of the membranes, around the vessels, or forming definite tumours by extension into the substance of the brain. We may distinguish different forms, the basic, gummatous, cerebro-spinal meningitis, with which is often associated an endarteritis, and, in the severe cases, gummatous projections into the substance of the brain. Such cases usually occur within the first few years after infection, hence the patients are usually young subjects ; they may suffer from headache, attacks of giddiness, transitory disturbances of consciousness, maniacal attacks, loss of memory, fits of depression and attempted suicide, and they may be found wandering at large and be taken up by the police ; sometimes ptosis, or squint, with some stiffness of the neck may indicate the meningitis ; usually there is no pyrexia, and this may throw one off one's guard. Transitory attacks of aphasia, monoplegia, or hemiplegia, owing to the disturbance of the circulation by endarteritis, may occur. Polydypsia, polyuria, and glycosuria may exist. Disturbances of vision are frequently met with, *e.g.*, transitory hemianopsia, but the most common, and the most serious, symptom is *affection of the optic nerves causing neuritis*, and eventually complete blindness by involvement of the chiasma and nerves, or tract in the gummatous process. Now, in general paralysis, there is *never* optic neuritis, but there may occasionally be primary optic atrophy. Nor is there, as a rule, coarse paralyses, such as would be occasioned by blocking of arteries. The existence of Babinsky's sign, or ankle clonus, or the wrist tap contraction, or jaw clonus, would point to coarse brain disease rather than to primary decay. These cases of severe syphilitic brain disease, in which the mental symptoms are the most pronounced, are often spoken of as *pseudo-paralysis*. They should be early recognised in the course of the disease, for energetic treatment often leads to good results. Another important sign of this disease is severe headache, worse at night, and often waking the patient up at a definite time in the early morning, also tenderness on percussion of the head, frequently in some definite spot.

Endarteritis Syphilitica.—Heubner showed that when more

than two arteries, forming the circle of Willis are affected, headache, disturbances of consciousness, attacks of giddiness, and convulsive seizures may supervene. Another characteristic of this disease is transitory attacks of aphasia, monoplegias, hemiplegias, word-blindness, and word-deafness, or hemianopsy, lasting a few minutes, a few hours, or a few days. These attacks are easily mistaken for a seizure of general paralysis especially when associated with weakness of memory, headache, and exaggerated knee-jerks, and sometimes pupil phenomena. Sooner or later, there occurs a coarse obtrusive paralysis, and this, in the vast majority of cases, affords a clear indication against the diagnosis of general paralysis; in fact, symptoms, pointing to transitory disturbances of the circulation, causing the above conditions in a syphilitic subject, should always lead to anti-syphilitic treatment. It is only rarely that one finds endarteritis syphilitica of sufficient intensity and extent to give rise to coarse paralyses combined with general paralysis. I have, however, seen a few such cases.

Syphilitic tumours, single or multiple, associated with a syphilitic meningo-encephalitis may lead to convulsive seizures, progressive dementia, severe headache, pupil phenomena, all of which may lead to the erroneous diagnosis of general paralysis; but such a case would be associated with optic neuritis and vomiting, owing to intra-cranial pressure; very frequently accompanied by some form of oculo-motor paralysis, such as ptosis, or squint, or internal or external opthalmoplegia. Treatment in such cases, when they have advanced to this extent, is not very hopeful.

Arterio-sclerosis, occurring in a patient getting on to fifty years of age, may be associated with melancholia and delusions of persecution. The arterio-sclerosis may be a late result of syphilis, and the possibility of general paralysis is thought of, especially if the patient has had some convulsive seizures. These convulsive attacks, however, may be uræmic in origin; in such case, examination of the urine for albumen and casts would help to make a diagnosis, which would furthermore be confirmed by evidence of cardiac hypertrophy, high-tension pulse, and examination of the fundus, revealing albuminuric retinitis, or hæmorrhages, for, as I have said before, it is seldom that a general paralytic shows any changes in the fundus

beyond optic atrophy, and this does not occur in more than 5 per cent. of the cases.

Cerebral tumours may occasionally be mistaken even by competent authorities for general paralysis. An instance, which occurred in my own practice, and which was also seen by one of the leading alienists, and in which we both diagnosed general paralysis, illustrates this :—

A man came to the hospital with reeling gait, unequal pupils, sluggish reaction to light, no noteworthy changes observed in the discs, a history of the feeling of a tight band round his head, progressive mental weakness, defective memory, strange in his manner, and having had a number of fits at intervals for some years; the speech hesitant and somewhat slurred, the knee-jerks exaggerated (especially the right), and a history of syphilis and alcoholism. Once in a good position, as stage manager, he sank into a degraded condition, and neglected himself, careless of the calls of nature and of his dress and appearance, and of his associates; in fact, his whole character seemed changed. He was sent to an asylum, and the charge-attendant, after all effects of alcohol had been removed, remarked that "he was a general paralytic, but he was not an ordinary one." He died, and I found, post-mortem, a slow-growing, non-vascular fibro-endothelioma, which had destroyed nearly the whole of the left frontal lobe, and a part of the right.

This tumour, no doubt, was the cause of the convulsive seizures, of the unequal pupils, and of the other symptoms from which he had suffered. The fact that it had slowly replaced the brain tissue, rather than compressed it, probably accounted for the fact that no optic neuritis was recognised, nor did he suffer from vomiting and the usual signs of cerebral tumour. Such cases, however, are very rare.

Perhaps the most difficult question of diagnosis obtains in cases of alcoholic *pseudo-paralysis*. I have seen such cases diagnosed as general paralysis, but, *post-mortem*, none of the characteristic morbid appearances were found. The reason why these cases are diagnosed as general paralysis is the existence of grandiose delusions of wealth, etc., associated with tremor of the lips and tongue, and perhaps, for a time, the pupils are sluggish to light. There may be some paresis, or even paralysis of the limbs with tenderness on pressure. The grandiose delusions, however, are usually only ascertained by conversation with the patient, unlike the general paralytic, who babbles of his wealth and strength unsolicited. Moreover, there is a tendency for the delusions to pass off when alcohol is withheld.

Polyneuritic psychosis, or Korsakom's syndrome, was formerly, and is sometimes even now, confounded with general paralysis, but it is a totally distinct disease. It is really a chronic form of delirium tremens, affecting mainly women, and is brought about by the effects of a microbial toxin on a chronic alcoholic subject. The symptoms are quite characteristic; there is mental confusion, loss of memory, especially of recent events, loss of orientation in time and space, illusions of personal identity, hallucinations and delusions generally of a terrifying character, or relating to marital or maternal instincts; a frequent delusion is of babies being in the bed, and of hearing the crying of babies, of burglars, thieves, and detectives. The knee-jerks are absent, or sometimes exaggerated, there is weakness in the limbs, which may go on to a complete paralysis, wrist drop, and foot doop, and, if the dementia is profound, there is loss of control of the sphincter. The patient may complain of burning pains, and put insane interpretations upon them. There is tenderness on deep pressure, and not infrequently, there is a history of syphilis, or venereal disease. There may be facial paresis, ocular paresis, and sluggishly-acting pupils. Such cases may terminate in a permanent dementia; but I have seen cases, in men and women, who have been admitted to the asylum with the signs of polyneuritic psychosis, which have eventually terminated in true general paralysis. A far more frequent occurrence is that a patient is admitted with acute *mania â potu*, but is really a general paralytic, who has taken to drinking heavily. How far are we to decide whether this is a case of alcoholism, or alcoholism in a general paralytic? An instance will show how difficult it is to do so:—

A man was admitted to the asylum, with a history of drink, and, shortly after admission, he had a series of fits; he was quite unconscious, and, for a few days after, he was the subject of delusions and hallucinations. A week later his mind was perfectly clear; he was a potential epileptic, in whom alcohol had induced a series of epileptic fits, followed by a post-epileptic psychosis, from which he recovered. Examination of his pupils, after he had recovered from the fits, revealved none of the signs, which I have previously described, and I was led to diagnose the case as *not* a general paralytic.

As another instance:—

A man, who had jumped off a tramway car, was admitted to Charing Cross Hospital. He was violently maniacal, theatening to shoot all those

around, said he was followed, and persecuted by voices calling him opprobrious names and accusing him of crime. I saw him a few days later at Hanwell; his pupils were equal, regular, and reacted to light and accommodation. I came to the conclusion that it was a case of acute alcoholic hallucinosis, and that he would recover in a short time, although he had been in an asylum not long before. A week later he was perfectly rational without hallucinations or delusions.

Another case, however, turned out quite differently :—

A man, admitted to Hanwell with a history of alcohol, had the delusion that his wife, who was dead, had been taken out of her coffin, and had gone away with another man to America, that he had seen this happen. He also had a delusion that she had visited him while in the asylum. His pupils were unequal, irregular in contour, and sluggish in action to light and remained so. He subsequently developed all the typical signs of general paralysis.

Another case :—

A man was admitted to Colney Hatch Asylum in a state of acute alcoholic mania. He had hallucinations of black devils, which came and perched on his nose, and put stinking things in his nostrils; he was violent, excited, and had to be put in a padded room. A week later, when I saw him, and the effects of the alcohol had passed off, a marked euphoria had taken the place of the terrifying hallucinations. He was a king with millions, and angels now came and moistened his lips with sweet things, and put perfumes into his nostrils.

It is a remarkable fact that the hallucinations and delusions of alcohol are usually of a terrifying character, and refer to black and grey creeping, crawling, horrible insects, rats, spectres of dead persons, policemen, burglars, coffins, etc.

Delusions of infidelity by the husband on the part of the wife, or the converse, are very frequent in chronic alcoholism.

In districts in which lead-poisoning is common, *lead encephalitis* may so closely simulate general paralysis, in many of its clinical symptoms, that some authorities consider lead a cause of this affection. Not long ago I had two brains sent to me to examine. They had been removed from patients said to have died of general paralysis caused by lead-poisoning. Of course, if fits and paralysis, accompanied by psychosis with delusions and hallucinations, are to be regarded as clinical evidence of general paralysis, then lead may be said to cause it. But for the same reason that the alcoholic polyneuritic psychosis is not general paralysis, so also is not lead-encephalitis.

Now these two brains, to my mind, showed neither the

naked-eye nor the microscopic changes characteristic of general paralysis. There was a little congestion and thickening of the membranes, but no wasting of the cerebral cortex, nor granulation of the ventricles. The membranes and perivascular spaces showed some cell-infiltration, but I observed no plasma-cells. The columns of ganglion cells were not distorted ; there was no cell or fibre destruction like that met with in general paralysis, the only noteworthy change of importance was a peri-nuclear chromatolysis of the large psychomotor Betz cells in the ascending frontal convolution, an indication that the patient had suffered for some long time from neuritis, as it exactly resembled the change met with in the cells of alcoholic polyneuritic psychosis.

In quite 10 per cent. of the cases of general paralysis there is a history of head injury. When we consider that blows on the head will cause traumatic neurasthenia, it is not surprising that general paralysis should result.

General paresis is a primary neuronic atrophy with secondary perivascular and glia-cell changes. The dementia is proportional to the destruction of the cells of the cerebral cortex. This destruction is most marked in the regions of the brain, the veins of which drain into the longitudinal sinus, namely, the fronto-central and parietal regions, for venous stasis is more liable to take place in these parts, owing to the blood having to flow against gravity in a direction opposite to the current. The cells of the cortex are destroyed, partly by an inherent defective durability and primary decay, and partly by congestive stasis, acting upon weakened nerve elements. The proof of this is shown by the following fact :— Not infrequently, a paralytic will have a number of convulsive seizures, limited to one side of the body, and post-mortem it will be found that the hemisphere of the opposite side may weigh from 30 to 100 grammes less than the other. It may therefore be concluded that the fits were an expression of the irritation of the dying cortical cell-elements. The congestive stasis is increased by the fits, and there is a tendency to the formation of a *circulus vitiosus*.

The prognosis in general paralysis is bad, but occasionally remissions occur ; and the fact that cures have been claimed by various methods of treatment may be due to the fact that

the disease, for a time, has become quiescent, which we know frequently occurs when a patient is placed in an asylum away from the exciting influences of drink, sexual excesses, and other forms of mental excitement. It is possible that, with our better knowledge of the causation of this disease by the discovery of the spirochæta pallida and its relation to syphilis, and the successful treatment of chronic trypanosome infections, new methods of treatment may be arrived at in the early stages of this fatal disease; for, of course, it cannot be expected that any treatment will restore new cells to the cerebral cortex, or give new life to the decadent neural elements. But, until we are better acquainted with its pathology, we cannot hope for successful treatment.

Recently, Ford Robertson has claimed to have discovered a diphtheroid organism, which he asserts is the cause of general paralysis, and he has named it Bacillus paralyticans. Moreover, he asserts that he has prepared a serum with which he claims to have produced beneficial effects. Hitherto his results have not been confirmed on the continent or in this country.

LUPUS ERYTHEMATOSUS: OBSERVATIONS ON ITS ÆTIOLOGY AND TREATMENT.

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Since M. Cazenave, in 1851, wrote his historical paper on Lupus erythematosus, and named and described the disease, its ætiology has been a favourite theme for discussion, at the various Societies and Congresses of Dermatology; but in spite of the extensive literature which now exists upon the subject, the causation of the disease is still a matter of controversy. In the experience of everyone, who has been called upon to treat lupus erythematosus, it has proved one of the most intractable and capricious of skin-diseases, and, consequently it will be of interest to consider what advances have been made in recent years with respect to the knowledge of its nature and ætiology, with the object of applying them to a more rational treatment of the disease. Six years before Cazenave published his paper, the affection had been described by Hebra, with the heading of "Seborrhœa Congestiva," under the impression that the seat of origin of the disease was the sebaceous glands. One of the characteristic features of the affection is a plugging of pilo-sebaceous follicles with small greasy plugs, like comedones, and it was this observation which led Hebra to the conclusion that it was a disease of the sebaceous glands. It was subsequently pointed out by Unna, however, that the plugs, which filled the orifices of the follicles, were composed chiefly of horny material, resulting from an abnormal activity of the cornification process of the epidermis, involving secondarily the mouths of the follicles, and that the affection was not essentially a sebaceous-gland disorder. Unna's observations were based on a study of the histology of the lesions. Though the descriptions of the histology of the disease vary considerably in detail, doubtless from the lesions being examined at different stages in their evolution, or from different type of lesions being studied, most authorities are agreed with regard to the main characteristics

which constitute the histological architecture. They regard lupus erythematosus as essentially a disease of the corium, and consider the changes, which occur in the epidermis, as being of a secondary nature. The earliest change takes place in the blood-vessels, which become dilated from some vaso-motor disturbance. The dilatation is followed by a peri-vascular infiltration of cells, which seems to have resulted from a proliferation of the endothelium of the vessels and the surrounding connective tissue-cells, possibly as the result of the irritating action of some toxin circulating in the dilated blood-vessels, or of some external irritant. Here and there the endothelial proliferation is so great as to almost block the vessels. In consequence of the prolonged action of the irritant, degenerative changes occur in the cells of the infiltration, some of which die, and thus set up a chemotactic action, which results in an inflammation of the affected area, associated with marked œdema, occurring chiefly in the papillary and sub-papillary layers. It is this œdema which induced Unna to liken the histology of the disease to a bog, covered with an apparently sound patch of mossy turf, which, if stepped upon, proved unsafe. The collagenous fibres became involved to a marked extent in the œdema. Then a certain degree of drying takes place, associated with a further degeneration, followed by a process of repair, as the inflammation subsides with the formation of new collagen fibres, and this leads to the scarring, which is a clinical feature of the disease. In the epidermis there is proliferation of the prickle-cell layer, hyperkeratosis, chiefly noticeable at the mouths of the follicles, and, where the underlying œdema is most marked, an imperfect cornification process and scaliness.

This, in brief, is the histological picture of lupus erythematosus, but the difficulty is to decide what is the cause of it. It is most generally believed to be produced by some local irritant, such as cold ; or to be the result of the presence of some toxin either generated in loco (Robinson),[1] or reaching the skin from some distant focus of disease, and attacking that part of the skin where the circulation is naturally weak, from anatomical reasons, such as the bat's-wing area of the face,

[1] *Trans. Amer. Derm. Assoc.*, 1898.

the auricles, and, more rarely, the hands. In these exposed situations where the skin is thin, and stretched over bone or cartilage, it is conceivable that irritants of diverse kinds might readily produce more or less permanent patches of hyperæmia. Hence the theory of the toxic origin of this disease has become greatly favoured by certain observers. But by far the most interesting aspect of it is that, which has been so strongly advocated by Boeck, of Christiania, and which has now been almost universally adopted by the French school of dermatologists, namely, that the toxin directly responsible for the lesions, is the tubercular toxin. In other words, that lupus erythematosus is one of the cutaneous manifestations of tuberculosis. It is chiefly on clinical grounds that this theory has obtained support. Histologically, the architecture of these lesions does not suggest a tubercular origin. Repeated search for tubercle bacilli in the lesions has been unsuccessful, and inoculation experiments on susceptible lower animals have invariably given negative results. Lupus vulgaris, on the other hand, presents a typical tubercular histology. Tubercle bacilli can be found in the tissue, and inoculation experiments give positive results. If then lupus erythematosus is a tubercular manifestation, it is not like lupusv ulgaris in being a reaction of the skin to the tubercle bacillus *in situ*, but must be due to the tubercular toxin, produced by bacilli at a distance from the skin. It is this view, which is generally adopted by the French dermatologists, and, in consequence, they have classified the disease as a "toxi-tuberculide." The reasons, which have induced the supporters of the toxi-tuberculide theory to adopt this view, are briefly as follows :—

(1) In a considerable proportion of the cases of lupus erythematosus, there is either a personal or a family history of tuberculosis. In support of this proposition, Boeck found that 28 out of 42 cases showed evident symptoms of present or past tuberculosis. Out of 250 cases, collected from the literature by Roth, in 185 there were evidences of tuberculosis; various cases of acute lupus erythematosus have been recorded which have succumbed to pulmonary, or other forms of internal tuberculosis (Brooke, Kaposi).

(2) In a certain number of cases, lupus erythematosus occurs in association with skin lesions, which are believed

to be of tubercular origin, such as certain cases of erythema induratum.

(3) In other cases it is associated with skin affections, which are considered to be probably due to the tubercular toxin (toxi-tuberculide), such as folliclis, lichen scrofulosorum, and necrosing chilblains.

On the other hand, there are various strong arguments against the tubercular hypothesis. If lupus erythematosus is due to the tubercular toxin, an injection of tuberculin, either for diagnostic or curative purposes, might reasonably be expected to bring out lesions of the disease, but though there are several instances of lichen scrofulosorum having developed in consequence of a tuberculin injection, I am not aware of its having caused lupus erythematosus. It must also be admitted, even by the strongest exponents of the tubercular hypothesis, that in a large proportion, if not in the majority, of cases of this disease, there is no personal evidence of, or family predisposition to, tuberculosis.

It has been suggested that a tubercular taint may be present and be unrecognised, and doubtless this might occur in occasional cases, for it is no uncommon experience to find an injection of tuberculin bringing to light a tubercular focus, which was unsuspected; but various cases have been lately recorded, in which a fatal issue took place from intercurrent disease, and in which, in the post-mortem examination, no trace of tuberculosis was detected.

The evidence, then, in favour of the tubercular toxin origin of this disease is, at present, far from complete, and it seems to me as equally convincing to argue that its association with tuberculosis is a purely casual one, as to assert that they are not dependent necessarily on each other.

Short of asserting that the tubercular toxin is the direct cause of the lesions, it has been suggested that the toxin is a predisposing factor, which, by weakening the individual, renders the skin more vulnerable to a variety of irritants. In other words, that lupus erythematosus is not a specific disease, but is one which may be brought about by a number of causes in a predisposed individual. To this point of view I shall have reason to refer later. Meantime, I wish to draw attention to the relation between lupus erythematosus and various circu-

latory disturbances, such as chilblains and Raynaud's disease, on the one hand, and the toxic erythema of the type of erythema multiforme, on the other.

Lupus erythematosus has been noted so frequently, as a concomitant of a weak peripheral circulation, that the relation between them seems to be more than an accidental one. In a large number of these cases, the patients suffer from cold hands and cold feet, the skin being moist and congested, and frequently presenting a bluish mottling extending from the back of the hands up the forearms. Such patients are often sufferers from chilblains, and, in a few cases, the more marked circulatory disturbances of Raynaud's disease have been recorded.

Congested hands, feet, and ears, chilblains, and the Raynaud's phenomena, all indicate a pathological state of the circulation at the periphery, associated with a weak vasomotor control. Except in the cases of ulcerating chilblains, and severe Raynaud phenomena which may be followed by scarring, those circulatory disturbances disappear, without leaving any trace behind them. Such circulatory derangements are frequently caused by exposure to cold, and occur in individuals whose peripheral circulation is in an enfeebled state from general defects in health. The connection between lupus erythematosus and a defective circulation is possibly that the latter acts as a predisposing factor, rendering the individual prone to react in the peculiar fashion of lupus erythematosus, when the skin is exposed to one or more irritants, acting either from within or from the outside.

The relation of lupus erythematosus to toxic erythemata of the nature of erythema multiforme has also been commented upon. All transitions may be met with between the acute type of lupus erythematosus, and the typical eruption of erythema multiforme, and, in some cases, practically the only differentiating point in the diagnosis is the presence of scarring or atrophy on the one hand, and its absence on the other. Scar-leaving toxic erythemata have been observed, in connection with various diseased conditions, associated with the circulation of toxins in the blood, such, for example, as cirrhosis of the liver and kidney disease. A case of this nature, in which cirrhosis of the liver and alcoholism were present, was recorded by

Dr. James Galloway and myself (*Brit. Jour. of Derm.*, 1903, XV., p. 81). Another somewhat similar case, that of a young woman, who died of nephritis, was also reported by us.

In the latter case, in association with the toxæmia, due to the kidney trouble, there was a violent dermatitis, which appeared about two months before her death. In this case, we had considerable difficulty in determining whether the skin affections should be regarded as an exceptionally severe erythema multiforme, or as an acute generalised lupus erythematosus. Drs. Sequeira and Balean also described an acute disseminated fatal case of lupus erythematosus, which closely resembled the case which we had labelled erythema multiforme, and, in this case also, there was nephritis (*Brit. Jour. Derm.*, 1902, XIV., p. 368). Recently, a fatal case of lupus erythematosus was described by Sydney Short (*Brit. Jour. Derm.*, 1907, XIX., p. 271), in which albumen was present in the urine, and, at the post-mortem, the kidneys showed marked cloudy swelling and small hæmorrhage. A few months ago, we had another case at Charing Cross Hospital, in which there were scar-leaving erythematous lesions, and lesions of the ringed type of erythema multiforme in the same patient.

But not only do the clinical appearances so closely resemble one another as to suggest that, in erythema multiforme and lupus erythematosus, we have differences which are more those of degree than of kind in a common pathological process, but the histological characteristics of the two conditions teach the same lesson. A comparison of sections of typical lesions of the extremes of both types has led one to the conclusion that the differences between the two are those of degree. In the case of erythema multiforme, the changes, both in the epidermis and the corium, were evidences of an inflammatory affection of the skin, resulting from a toxin reaching it *viâ* the blood-vessels. Whereas, in lupus erythematosus, the changes appeared to be caused by an inflammatory process, less acute, due to a less virulent toxin, or irritant, acting over a more prolonged period, and occurring in situations where the vaso-motor control was feeble, and where the skin was stretched over bony or cartilaginous surfaces, like the scalp, malar prominences, nose and ear, and the finger joints, so that when hyperæmia occurs, paralysis of the vessel, œdema and

degeneration are likely to take place. Consequently the process of repair of the tissue is imperfect, and scarring results.

It may be asked, What, then, is the real cause of the difference between the typical lesions of lupus erythematosus and those of erythema multiforme? Is it some predisposition?

Brocq has recently described lupus erythematosus as a peculiar type of reaction of the skin in certain individuals, which may be called forth by a variety of irritants, both external and internal. The exact nature of the predisposition, idiosyncrasy, individual peculiarity, or whatever it may be called, which renders the skin liable to react after the manner of lupus erythematosus, is, however, uncertain.

The comparison of lupus erythematosus and erythema multiforme is helpful up to a certain point, but it does not solve the problem. It is conceivable that the same toxin, in different circumstances, might produce the two affections. The predisposing factor, which enables it to cause lupus erythematosus, may be some defect in general health, accompanied by a circulatory disturbance. The actual cause may be a variety of agents, such as toxins circulating in the blood from digestive troubles, kidney derangements, and uterine disturbances, or the local effects of various irritants and atmospheric conditions, of which the most potent is probably cold.

TREATMENT.

In a disease, in which the ætiology is still sub judice, a perfectly rational mode of treatment is not available, and the number of remedies which have been put forward from time to time for its cure is consequently large. For not only is the disease singularly intractable, but it tends, at times, to spontaneous involution, and various forms of medicament, which happen to be in use while the lesions are disappearing, often get the credit of being cures.

So far as is possible, the basis of treatment should be the pathogenesis of the disease, but, failing that, we are thrown back on the histo-pathology of the lesions to guide us. The treatment is naturally divided into internal and external.

The indications, with regard to the internal treatment, are briefly as follows:—

1. The general health of the patient should be dealt with

on general principles, and any obvious derangements counteracted by suitable means.

2. Anything which tends to cause dilatation of the cutaneous blood-vessels and flushing, such as hot drinks, alcohol, condiments, and the like, should be scrupulously avoided.

3. Toxins, circulating in the blood, should be counteracted by various drugs, such as quinine, arsenic, iodide of potassium, and salicin.

Salicin has been employed, with benefit, in the acute disseminated cases. Radcliffe-Crocker, who strongly advocates its employment, begins with doses of grs. xv. t.d.s., and increases the amount to 20 or even 30 grams at a time. Besides its action on the toxin, salicin is a cardiac depressant, and reduces the hyperæmia.

Another drug, which has had considerable vogue in the internal treatment, is ichthyol. It was employed extensively by Unna, in doses of about 5 m., in capsules, three times a day. It is believed to have an action in reducing the hyperæmia also, but, so far as my experience goes, the results obtained from it have been disappointing. Quinine was recommended by Payne, and its action can be intensified by painting the lesions, at the same time, with tincture of iodine, and some most favourable results have been recorded by this method.

These form the principal drugs which have been credited with a specific action on lupus erythematosus. Even the best of them is uncertain, and the injudicious use of them is capable of doing a great deal of harm. On the whole, more benefit is to be derived from the treatment of the patient on general medical lines than by depending on any so-called specific.

External remedies are probably of greater importance than internal treatment, and, with these alone, cases have been undoubtedly cured.

On general principles, the first thing to be done is to protect the skin from such harmful influences as we know are capable of producing the disease, such as cold, exposure to wind, etc.

The first indication for the local treatment, from the histopathological point of view, is to reduce the hyperæmia and moisture, for, though dry on the surface, immediately beneath the scaly stratum corneum, there is a moist epidermis and an

œdematous corium. For this purpose mild remedies, such as powders, lotions, and pastes act best. As an example of each the following may be given, as a powder : Equal parts of magnesium carbonate, zinc oxide, and prepared calamine ; as a lotion : Prepared calamine, gr. xv. ; zinc oxide, gr. x. ; glycerin, ℥xxx. ; aq. calcis, ʒi. ; aq. rosæ, ad ℥i. ; and as a paste : Ichthyol, ℥x. ; zinc carb., ʒiss. ; starch, ʒii. ; lanolin, ʒii. ; vaseline, ʒii. These preparations all tend to dry the skin, and assist the tendency of the lesion to heal spontaneously.

Another method of reducing the hyperæmia is by means of compression. This can be done by a method suggested by Unna, namely the painting on of collodion three times a day. To augment the action of the collodion, by removing the scales, soft-soap, in the proportion of 1 in 16, may be added, or to reduce the hyperæmia, ichthyol in the same strength. In occasional cases, this method gives good results.

The removal of the adherent scaliness is a matter of great importance in the treatment. This may be done effectively by rubbing the lesions with Hebra's soap spirit lotion on a piece of flannel, or lathering it on with a shaving brush. The lather is subsequently wiped off with a sponge, and the calamine lotion, paste, or collodion then applied.

Another method of doing the same thing is to add oxidised pyrogallic acid ʒss to an ounce of the paste. This drug does not inflame the skin, and it reduces the scaliness.

All these methods of treatment may be regarded as mild local remedies, but give more satisfactory results than the formerly employed strong caustic destructive applications, such as sublimate ointment, carbolic acid, and nitrate of mercury, silver nitrate, etc. By these methods, the lupus erythematosus may be destroyed, but, as a rule, only at the price of a disfiguring scar. I recollect seeing a case, which had been treated with acid nitrate and mercury, on a great many occasions by Erasmus Wilson, and though the lupus erythematosus had almost completely gone, the degree of disfigurement resulting from the scar was sufficient to deter one from the employment of the methods. Caustics are only permissible in the case of small discoid, very chronic patches, with a thick scale, in which case it is a good plan to paint the

lesions once a week with pure carbolic, or with 10 per cent. solution of resorcin in spirit.

Of the various operative measures, such as scarification, electrolysis, and the thermo-cautery, in the case of small lesions, and, in the hands of an expert, good results may be obtained; but these methods are most unsuitable for routine treatment, they all act by closing the dilated vessels, and are succeeded by a scar, but, if carefully done in suitable cases, the scarring may be slight.

In conclusion, I must refer briefly to the most modern treatment of lupus erythematosus, by means of radiotherapy, namely, by the actinic rays, the X-rays, and high frequency.

During the last year I have employed the actinic rays from a Finsen-Reyn lamp, in four cases, and, in all four, there has been improvement. They were all cases of the discoid type. In one case, in which there was a single patch, about the size of a five-shilling piece, situated on the left cheek, which was raised, and covered with thick adherent scales, the exposures were given in the ordinary way, and the patch almost completely disappeared under the treatment. The patient, an adult woman, had about 30 exposures of from half to one hour's duration, and the result was highly satisfactory. In the other cases, the improvement has not been so marked, though it has been undoubted, and the patients themselves have recognised this, and are anxious to continue with the treatment. By the ordinary method of exposure, comparatively little benefit was derived, but when the plan of exposing the skin at a distance of about 10 inches from the lamp for half an hour every second day, and without employing a compressor was adopted, improvement began. This procedure was suggested by Norman Walker, and my experience of it bears out his own testimony regarding it. Where there is much thickening it would appear to be preferable to employ the compressor, and to attempt to get a definite inflammatory reaction; where the patches are very superficial, such a procedure may aggravate rather than improve the lesion, and it is better to expose the patient at a distance from the lamp without a compressor. Theoretically, the reaction from a Finsen lamp should result in the breaking down of the defective blood-vessels, and cause

the removal of the cellular infiltration. Unfortunately, it is this type of tissue, where the vessels are in a weakened state, which does not react well. X-rays have also been frequently employed in this connection. In very small doses, they stimulate the skin, and might improve the lesion, but should an X-ray reaction supervene, especially on a tissue so devitalised as is a patch of lupus erythematosus, the consequences might be most serious. So far, and I have tried the rays in several cases, I have seen no distinct benefit from their use. With regard to the high-frequency currents, cases have been reported in which benefit has taken place, while they were being employed, but in the main, so far as I can gather, the results have been disappointing. They cause a hyperæmia, which persists, for from a few hours to a day, and cause considerable discomfort, if not actual pain, in the process. In one of my cases, which I have carefully exposed to high-frequency discharge, instead of improvement resulting, the patches became angry and spread, and, on account of the pain it produced, the patient refused to continue with the treatment. In short, so far as my experience of the radio-therapeutic methods goes, the Finsen lamp is the most effective of the three, and occasionally gives encouraging results.

THE URETHRA.

(*a*)—The Anatomy of the Urethra.

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The urethra in the male is a canal, about 8 inches in length, between the interior of the bladder and the exterior of the body, and serves for the escape of urine, the secretion of the testes, vesicular seminales, prostate, Cowper's glands and urethral glands.

From its internal orifice to about the attachment of the suspensory ligament to the penis, the urethra is in more or less fixed structures. At its commencement it lies in the prostate, which is fixed at the base by the visceral layer of pelvic fascia, and at the apex by attachment to the parietal layer of the pelvic fascia, forming the superior layer of the triangular ligament.

The urethra is intimately connected with the triangular ligament, which it pierces about 1 inch behind the symphysis pubis. For about 2 inches in front of the ligament, the urethra is fixed by the attachment of the bulb to the inferior surface of the triangular ligament, and also from the fixation of the corpus spongiosum by the suspensory ligament at the angle of the penis. This suspensory ligament is a fibrous structure, passing from the anterior abdominal wall and front of the symphysis pubis to the penis, which it envelops as a loose ring. It is important here to note that the urethra is most definitely fixed, as it pierces the triangular ligament; and so, when a straight rigid instrument is passed into the bladder, the angle of the penis is obliterated and the prostatic portion must also accommodate itself to the instrument.

In front of the suspensory ligament, the penis and contained urethra are freely mobile.

The *prostatic urethra*, 1 to 1¼ inches in length, descends from the base to the apex of the prostate, somewhat nearer the posterior than the anterior surface of the gland. It is almost vertical in its first part, but, in the lower portion, turns

forwards so as to leave the prostate just in front of the apex of the gland.

In a horizontal section of the prostate, the urethra appears crescentic in outline from the projection forwards of the verumontanum. If the urethra is opened up through its anterior wall, the verumontanum will be seen as a ridge extending the whole length of the part. About the middle of the ridge will be seen a slight swelling, with the openings of the utriculus masculinus and the common ejaculatory ducts. Below the opening of the utriculus masculinus, the verumontanum is a sharply-defined crest, above the opening it is broadened into a triangular-shaped area corresponding with the so-called third lobe of the prostate. The ducts of the third lobe open on this area. On either side of the verumontanum, there is a groove, the sinus prostati, into which open the ducts of the lateral lobes.

The prostatic urethra is probably the widest part of the canal, though constricted at upper and lower ends.

The prostatic section admits of considerable dilation in all parts.

The membranous urethra, somewhat less than ½ inch in length, is that part which curves downwards and forwards between the two layers of the triangular ligament.

This is the most firmly fixed and the least dilatable part of the urethra, excepting the meatus. When the canal is empty it has a stellate appearance on transverse section.

The compressor urethræ muscle, which lies between the two layers of the ligament, surrounds this part of the canal, and Cowper's glands are also lying in close relation behind and to the outer side.

The spongy portion of the urethra, about 5½ inches in length, extends from the triangular ligament to the external meatus within the erectile tissue of the bulb, corpus spongiosum, and glans. The fixed proximal part is directed forwards and slightly upwards, whilst the movable distal part follows the curve of the pendant penis.

The urethra enters the spongy tissue about ½ inch from the posterior extremity of the bulb, and, at this point, there is only a thin layer of erectile tissue on the anterior compared with that found on the postero-inferior aspect. Farther forward, the urethra has a more central position in the corpus spongiosum.

The lumen of the spongy portion varies in size and form in parts. There is a marked dilatation in the bulb of a fusiform character, abruptly narrowing toward the pars membranacea. This section is the most dependent part of the fixed urethra, is very thin walled, and comparatively mobile. There is another dilatation immediately behind the external meatus in the glans penis, known as the fossa navicularis.

The ducts of Cowper's glands open into the floor of the fossa bulbi. The glands of Littré are most plentiful in the upper wall of the urethra, and are most numerous in the anterior half of the spongy part.

In the roof of the spongy urethra will be seen a number of pits, termed lacunæ urethrales, with the orifices directed toward the external meatus. One of them, in the roof of the fossa navicularis, is exceptionally large.

The external meatus is the narrowest part of the urethra, and the least dilatable.

Embryologically, in the male, the urethra consists of two parts, a posterior, originally derived from the hind gut, and an anterior, from the meatus to the posterior part of the fossa navicularis, formed by an ingrowth of the cutaneous epithelium of the penis. At the junction of these two parts, deformities may occur, some of which may form an obstruction to outflow of urine, and may be of the nature of a congenital stricture. By far the commonest site of congenital narrowing of the canal is at the meatus, though congenital strictures have been described at almost all parts of the urethra.

The male urethra consists of a mucous membrane containing a rich venous plexus. In the prostatic and membranous parts there is a coat of involuntary muscle, but, in the spongy urethra, this layer cannot be traced farther than the bulbous portion.

The muscle fibres are arranged in two layers, inner longitudinal and outer circular. The circular layer is particularly well developed at the internal urethral orifice.

The mucous membrane is clothed with an epithelium which varies in different parts. In the upper two-thirds of the prostatic part, it resembles the epithelium of the bladder, and is of transitional variety.

In the lower third of the prostatic urethra, and the membranous and spongy urethra, as far as the hinder end of the fossa navicularis, the epithelium is columnar in character. In

the fossa navicularis the epithelium is stratified squamous.

The perinæal relations of the urethra are important from the surgical standpoint.

A metal instrument within the urethra can be readily palpated from the perinæum as far as the triangular ligament, and as far as the bladder by a finger in the rectum.

Having removed the skin of the perinæum, a condensed layer of superficial fascia (the fascia of Colles) is exposed. This fascia, attached to the base of the triangular ligament and to the ramis of ischium and pubes on either side to within a short distance of the symphysis, forms, with the under surface of the triangular ligament, a fascial pouch.

This pouch is closed behind and at the side, but open in front, where the fascia of Colles is continuous with the fascia of Scarpa from the abdominal wall. Laterally, the fascia of Scarpa is attached to the deep fascia of the thigh just below Poupart's ligament.

It is obvious, therefore, that effusion into this pouch can track forwards in the perinæum, in the scrotum, and to anterior abdominal wall, but will not be able to extend into the thigh.

The fascia of Colles having been divided, the bubo cavernosis muscle will be found lying on this bulb. These strictures having been cut through, the urethra in front of the triangular ligament would be exposed.

(*b*)—The Causes and Varieties of Urethral Stricture.

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Obstruction to the passage of urine from the bladder can be brought about by a variety of causes, which fall into two great groups. In the former of these, the obstruction is caused by a temporary condition either of the mucous membrane—congestive stricture—or of the muscular tissues, which surround the urethra — spasmodic stricture. In the second group, there is a definite structural change in the urethral wall, which narrows the lumen, and impedes the flow—organic stricture.

The separation between these two groups is, however, not

so sharp as it would at first seem to be ; for example, an organic stricture may be complicated by swelling of the mucous membrane, and total retention of the urine brought about, in a case in which the actual narrowing of the urethra had not been very marked. Again, many cases, in which the condition of swelling of the mucous membrane has precipitated the onset of acute retention, are still further complicated by spasm of the surrounding musculature. Indeed it is uncommon to find a case of organic stricture without a certain amount of spasm.

The former group of strictures is divided into two :—

(a) *Congestive Stricture.*—This condition is practically always brought about by an attack of gonorrhœa. The acute swelling of the mucous membrane encroaches upon the lumen of the urethra, until it is, with the greatest difficulty, that any urine can be passed. The amount of swelling is never great enough to completely block the urethra, but micturition is often so intensely painful that the patient involuntarily refrains from passing his water, and thus what is practically retention of urine supervenes. These cases are also complicated by spasm, the pain caused by the passage of urine starting the reflex, which leads to contraction of the muscular tissue of the urethral wall.

(b) *Spasmodic Stricture.*—The urethra is surrounded, especially towards its posterior portion, by a considerable amount of muscular tissue. Part of this is unstriated, involuntary muscle supplied by sympathetic nerve fibres *viâ* the hypogastric nerve. This portion is continuous with the outer layer of the vesical musculature, and forms an integral part of the urethral wall. The other portion, the compressor urethræ, is composed of striated voluntary muscle, which surrounds the membranous portion of the urethra, between the two layers of the triangular ligament, and is innervated by the pudic nerve. In spasmodic stricture, it is the unstriped muscle which is mainly concerned.

The efficiency of this contraction has been recently studied experimentally by Elliot. This observer exposed the bladder supra-pubically in a cat, and then passed a tube from the bladder a short distance into the proximal end of the urethra, where it was tied in. A second tube was then passed from the distal end up to, but not meeting, the first tube, leaving a centimetre of urethra between the ends of the two tubes.

Fluid could then be made to pass from one tube to the other through the connecting portion of the urethra. Stimulation of the hypogastric nerve caused contraction of the urethra, preventing the fluid flowing from one tube to the other. In this way, he was able to measure the amount of pressure which the urethra was able to support by contraction of its muscular wall. He found that 1 centimetre of urethra could be made to uphold a pressure of from 50 to 60 centimetres of water.

The hypogastric nerve not only exercises a motor influence over the musculature which closes the bladder, but it also has an inhibiting action over a certain part of the bladder muscle, so that, when reflex stimulation of this nerve occurs, there is not only an obstruction to the outflow, but also a diminution in the contractile power of the bladder. The so-called spasmodic stricture has therefore two factors in its constitution, and it is probable that, in many cases, the inhibitory action on the bladder wall is at least as important as the actual spasm of the urethra. Thus, in many cases, although the patient is unable to pass a drop of urine unaided, a full-sized catheter can be introduced without meeting with the slightest resistance.

In such cases also, it is common to find that the bladder is distinctly atonic, and can only be completely emptied by supra-pubic pressure. This is the type of spasmodic stricture, which occurs in inflammations of the peri-urethral tissues, and after operations on the pelvis. In those cases, in which there is spasm complicating an organic stricture, it is probable that there is a pure spasm of the urethral muscle, and, as unstriped muscle is very difficult to fatigue, the spasm can be maintained for a very long time. Many cases occur in which it is impossible to pass a catheter through a stricture, but in which the instrument can be passed into the opening of the stricture, where it remains tightly gripped. If, however, the instrument is left in this position for a few hours, it is then found that the catheter can be passed readily through the stricture into the bladder. Here the actual organic stricture has been of sufficient size to admit the catheter, but the spasm, which accompanies the constriction, has been so marked, that the instrument could not be passed.

TRAUMATIC STRICTURES.

Injuries of the urethra may be divided into several classes :—

(*a*) Incised wounds.

(*b*) Injuries produced by a fall, astride some hard body, such as a railing, a scaffold pole, by falling in a sitting position upon a sharp stone, or even by being thrown forward against the pommel of a saddle.

(*c*) By a kick or blow in the perineum.

(*d*) As a complication of fracture of the pelvis.

(*e*) Lacerated wounds produced by foreign bodies, or by catheters.

Incised or lacerated wounds of the urethra are not common, but when they do occur they are usually situated anterior to the peno-scrotal fold. The tendency to the formation of stricture very largely depends, as in all cases of urethral injury, upon the amount of urinary infiltration, and upon the degree of separation between the cut edges of urethral wall. In a longitudinal incision, such as is made by the surgeon to remove a calculus, or as a preliminary to an operation on the posterior urethra, the freedom of communication between the lumen of the canal and the exterior allows the urine to escape freely, and if the urine is sterile, there will be no inflammatory tissue formed around the wound. There is, moreover, no tendency to separation between the cut edges, and, in consequence, these wounds tend to heal readily, and without any stenosis of the urethra.

In transverse wounds of the urethra, there is a distinct tendency to the formation of a diaphragmatic stricture, unless the edges of the wound can be accurately united. If the wound involves only a part of the circumference, there is, of course much less tendency to separation of the cut edges, and less liability to stricture formation. Experiments on dogs have demonstrated that there is nothing in the urethra itself, which specially hinders primary union, stricture being brought about by the scar tissues formed between its cut edges, or as the result of septic infection. This may occur either from infected urine or from outside.

In laceration of the urethral mucous membrane, by calculi or foreign bodies, there is no marked tendency to stricture formation. In fact, the urethral mucous membrane, like all the mucous membranes, heals readily. It is surrounded, however, by sub-mucous tissue, and by the corpus spongiosum, and it is the infiltration of this, by inflammatory products, which leads to the formation of strictures.

Injuries, produced by a fall astride, or by blows in the

perineum, are found most commonly in the bulbous and membranous portion of the urethra. The mechanism of their production is comparatively simple, the urethra being forcibly compressed between the lower edge of the pubic arch, which is a sharp ridge of bone, and the object upon which the patient has fallen. The degree of injury sustained varies from a slight bruising of the peri-urethral tissues, without any laceration of the mucous membrane itself, to a complete rupture of the whole urethra with wide separation of the torn edges. This separation may be as much as 2 centimetres. Some of these cases do not attract very much attention at the time that the injury is sustained; the patient notices that he has had a fall, and the parts feel tender and bruised for a few days, or there may even be slight dysuria. Subsequently, however, often after the lapse of years, a stricture develops, and it is only after careful enquiry that a history of an injury can be obtained. These cases have been termed by French authors "interstitial rupture of the urethra," and the name indicates fairly well the actual nature of the injury.

The middle of the bulbous portion of the urethra is surrounded by the corpus spongiosum, a structure which consists of a number of intercommunicating venous channels, separated from each other by fibrous septa. An injury to this structure leads to the rupture of some of these septa, so that a hæmatoma is produced. The coagulation of the blood, which is thus stagnated, leads to the obliteration of the venous sinuses, and to the formation of a mass of granulation tissue in consequence of the organisation of this clot. It is now quite easy to understand that this will be replaced by fibrous tissue, which, in its turn, will contract, and lead to the formation of a stricture.

When there has been more severe injury, the rupture extends through the urethral mucous membrane. Although the amount of internal injury may be very extensive, it is not common for the skin itself to be wounded, so that these cases present a different clinical picture from that of an incised wound. In the latter group of cases, although the urine cannot pass along its natural channel, any that escapes through the wound of the canal, passes freely through the opening in the skin. In these cases, the extravasated urine is unable to find a passage, and, consequently, makes its way into the cellular tissue of the perineum, and the lower portion of the abdomen,

leading to the formation of a large mass of mixed urine and blood surrounding the urethra. Unless promptly dealt with, these cases almost inevitably suppurate, and the amount of injury to the urethral wall is increased by the sloughing, which takes place in consequence. If the patient survives, the abscess will point in the perineum, and rupture. The patient will thus have a fistulous track communicating with the urethra, and, in a bad case, the whole of the urine will pass along this, none coming through the meatus, and, in time, the portion of urethra in front of the injured spot will become obliterated.

Fortunately, however, the severity of the initial symptoms usually leads to prompt surgical interference, and where the torn edges of the urethra can be sutured, and asepsis maintained, the amount of cicatricial contraction may be very small; if, however, the separation of the ends is very marked, and so much tissue is destroyed that accurate suture is impossible, a zone of granulation tissue will form between the torn edges, and, becoming converted into a contracting scar, produce a very intractable type of stricture.

In fractured pelvis, rupture of the urethra forms one of the most dangerous complications. The degree of injury varies considerably, the urethra being in some cases completely torn across, where it is nipped between two fragments of bone, or it may be merely lacerated by isolated spicules broken off from the pubic arch. Strictures are produced by injuries of this nature in exactly the same way as in the preceding group.

The laceration of the urethra by foreign bodies, such as calculi, does not, as a rule, give rise to much stricturing, but if the foreign bodies become lodged, producing extensive ulcerations of the urethral wall, a stricture can be produced by the cicatrisation of this ulcer. False passages made by catheters do not necessarily lead to stenosis, although the presence of a number of them, around the opening of a stricture, will tend to increase the amount of inflammatory material, and so exaggerate the preceding condition.

Post-Inflammatory Stricture.—By far the greatest number of strictures are of this kind, and practically all of them are due to repeated attacks of gonorrhœa. A very dense type of stricture is formed by the cicatrisation of a urethral chancre. A single attack very rarely leads to the formation of a stricture, unless it has been unusually severe, or has lasted a very long time. Some cases give a history of only one attack, but in

these it will generally be found that, while there has been only one acute attack, there have been several slight increases in the discharge following succeeding infections. Apparently the patient has acquired a certain amount of immunity to the disease, and subsequent nfections do not produce the same acute symptoms as the primary one. These infections, however, while they do not cause any acute disturbance, none the less keep up the urethral inflammation, and bring about stricture of the urethra. It is possible there are other factors beside the infective process in the causation of stricture. In some Mohammedan countries, at least, although gonorrhœa is even more common than in England, stricture is very rare. This may be due to the climatic differences, or to the fact that much less alcohol is drunk.

When the urethra of a patient, who has been subject to such repeated attacks of gonorrhœa, is examined by the urethroscope, an area of mucous membrane will be found deeply congested, and often sharply marked off from the normal mucous membrane. If the urethra is inflated, it will be quite easy to define this area, quite apart from the difference in colour. It does not dilate as readily, or to the same extent, as the normal portion. This indicates a certain amount of infiltration of the submucous tissues with the products of chronic inflammation, which by their contraction will produce a stricture. A more direct infection of the submucous tissue may be brought about by infection of the glands of Littré, the infection being then conducted directly into the deeper tissues of the urethra.

Post-inflammatory stricture very rarely, if ever, occurs on the vesical side of the triangular ligament. Anteriorly to this, the urethra may be affected in any part, but there are two parts which are especially prone to stricture. From the triangular ligament to the meatus, the urethra does not form a straight tube, but there is, in the normal flaccid condition, an acute bend, where the suspensory ligament of the penis attaches this organ to the symphysis. This peno-scrotal fold forms a sort of watershed between the two portions of the urethra. It will be readily seen that any discharge in the part of the urethra, anterior to the peno-scrotal fold, will run out at the meatus, and the drainage thus established leads to the rapid recovery of the mucous membrane without deep infection. Gonorrhœa always commences as an anterior

urethritis, spreading backwards as time goes on to the posterior urethra and to the bladder. It will be readily understood from a consideration of the above anatomical points that, if the disease remains limited to the anterior urethra, it is usually unimportant, and does not lead to stricture. As the disease spreads posteriorly, it reaches the peno-scrotal fold, and here there is a less efficient drainage, the two sides are closely pressed together, imprisoning the discharge, so that the disease is much more resistant. Behind the fold, the drainage is still less efficient, the discharge tending to run backwards, and to accumulate at the lower end of the bulbous portion, being prevented from passing backwards into the bladder by the tonic contraction of the compressor urethræ. The persistence of the inflammation in this part of the urethra explains the frequency with which strictures are found there.

When once the submucous tissue has become infected, and there has been the usual round-celled infiltration, the process usually goes on to the formation of fibrous tissue. The urethra seems to be one of those organs in which the absorption of fibrous tissue does not readily take place. While, in some parts of the body, the dense fibrous tissue in a scar tends to become softer as time goes on, in the urethra this process does not seem to take place, contraction going on steadily for many years. This is probably due to a certain extent to the continuance of the irritation, but there must also be some determining factor in the tissues themselves, which prevents the spontaneous resolution of the stricture. The personal equation may also be a factor which comes into play. In some patients, a scar, left by an aseptic operation, will, in a few weeks, be quite invisible, while in others an incision, which, when first healed, looked precisely similar, has become cheloidal, contracted, and puckered. Post-inflammatory strictures are usually single, but it is by no means rare to find two of them in the same patient. More than two are uncommon, but strictures may be met with throughout the whole of the urethra.

According to their shape and extent, strictures have to be divided into several classes,—band stricture, ribbon strictures, and so on, but this classification is unimportant.

The untouched stricture usually consists of a simple zone of the urethra, a fifth to half an inch in length, lined by mucous membrane distinctly lighter in colour than the normal. Behind

this the urethra is generally distinctly dilated, as a result of the increased pressure necessary to evacuate the bladder, and the distension may affect not only the urethra, but the bladder, ureters, and even the pelves of the kidneys. Owing to attempts, either of the patient, or of the surgeon, to pass an instrument, the strictured zone becomes much more complicated in structure, bands of fibrous tissue extend from one side to the other, the lumen becomes tortuous, and there may be several openings in the face of the stricture leading to false passages. A case came under observation quite recently, in which the patient had attempted to pass the catheter with the stilet *in situ*, and projecting through the eye, with the result that there was an extensive laceration of the urethra, making it impossible to pass any instrument at all. Healing and subsequent contraction would be fairly certain to make such a stricture very complicated. The formation of false passages and tears around the original stricture not only deform the lumen of the urethra, but also, in their healing and subsequent contraction, lead to the formation of more and more dense fibrous tissue, so that the stricture ultimately becomes almost cartilaginous in hardness.

Congenital Stricture.—The urethra in the male is developed in three portions. The prostatic and membranous portions are developed from a part of the urinogenital duct. The penile portion, as far as the root of the glans penis, is formed by the apposition of the genital folds which grow up and meet in the middle line. The urethra, which is contained in the glans itself, is formed by the hollowing out of the column of epithelial cells. Complete absence of the urethra is extremely rare, being only found in association with the gravest defects of development, and the same may be said of those cases, in which the urethra is formed, but never becomes patent, persisting as a fibrous cord. A mild degree of this latter condition occurs, and is of some clinical importance. Stenosis of congenital origin may be found in any part of the urethra, either as an obliteration of the lumen for some distance, or as an incomplete membranous septum, stretching across the urethra. It is easy to see the cause of these, from the method of the development of the urethra.

In the glans, there is often a considerable amount of stenosis produced by imperfect canalisation of the cord of cells. In some cases, this is complete, and the urethra, behind

the obstruction, is found dilated into a cyst-like structure. In other cases, a membrane is left, which ruptures readily before birth, allowing the urine to escape. In a very large number of cases, the meatus is left extremely small, and these cases are of great practical importance. The symptoms presented are those usually associated with phimosis, and the child is accordingly circumcised. This operation does not relieve the child's dysuria, and it is only when the meatus is enlarged that relief is obtained. Torsion of the penis is a comparatively rare deformity, which gives rise to obstruction of urethra. Torsion to such an extreme degree is rare, but torsion through 90 degrees is no means uncommon.

Stricture following the Operation of Prostatectomy.—While the majority of patients, who have been submitted to this operation, have no difficulty after the operation has been performed, a certain number of cases subsequently develop stricture. At the conclusion of the operation, the patient is left with a ragged cavity between the bladder and the torn ends of the urethra, at the upper portion of which the mucous membrane, which has been stripped off the projecting portion of the prostate, hangs as an irregular curtain around the edge of the raw rough cavity. In a favourable case, this mucous membrane covers in the whole of this raw surface, the extent of which is, of course, much diminished by its subsequent contraction, and, ultimately uniting with the mucous membrane of the urethra, produces a condition not far removed from the normal.

It occasionally happens, however, that this regular healing does not take place, and the mucous membrane forms a sort of valve across the opening of the urethra. This becomes strengthened by the fibro-cicatricial bands, and may form a very considerable resistance to the passage of urine. In some cases, it is possible to evacuate the bladder by means of a catheter, although the eye of the instrument could not be actually passed into the bladder, being caught by a fold of mucous membrane just behind the symphysis. In other cases, a true stricture, develops the scar produced at the neck of the bladder contracting, and forming an irregular channel, through which urine passes with difficulty, and which it is almost impossible to catheterise.

(*c*)—The Treatment of Stricture by Bougie.

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Stricture of the urethra can, in the great majority of cases, be efficiently and most conveniently treated by dilatation. Internal urethrotomy is more rapid, if the stricture is a tight one, and only admits a small instrument; but it not only necessitates an anæsthetic, which is still a serious matter in the eyes of many people, but also the patient must be prepared to go to bed for a week, and this is often a difficult, if not an impossible arrangement, for a busy man.

Electrolysis, divulsion, and caustics have been given a thorough trial in the past with unsatisfactory results, and, as methods of treatment, need only be mentioned to be dismissed from serious consideration.

Dilatation of a stricture may be either intermittent or continuous, and of the two, intermittent dilatation is the more convenient and more frequently adopted, for it can be carried out without interfering with the daily life or work of the patient.

At the first visit, the position and size of the stricture are ascertained, and then the largest instrument is passed which the stricture will easily take. The subsequent visits should not take place more frequently than at intervals of three or four days, as otherwise the reaction, which usually follows instrumentation, is not allowed for, and the surgeon, by his misapplied energy, makes his task more difficult, and obtains a less satisfactory result.

At each visit, a bougie, a size smaller than the largest that was passed on the previous occasion, is first introduced, and this usually runs through the stricture easily. This is followed by larger instruments until further dilatation is impossible without using considerable force; then the sitting should terminate. In this way the majority of strictures will soon be fully dilated.

It is generally agreed that strictures should be dilated up to 15 E., though some surgeons are content with less, and take, as the limit, the largest instrument which can be introduced through the external meatus, without excessively stretching it. This, as a rule, is a fair guide, but occasionally the meatus is so small that meatotomy is necessary in order to allow the

stricture to be efficiently dilated. When once the full size is reached, it must be maintained by the passage of bougies at intervals, which can be increased according to the tendency to recontract. Thus the interval may be increased from a week to a fortnight, to a month, and perhaps even to six months. Some cases remain cured, but others require dilatation at regular intervals.

Except in expert hands, soft bougies are preferable to the steel or silver instruments for strictures of a calibre less than 7 E. This is a point which has caused much discussion, and the late Sir Henry Thompson ultimately declared himself strongly in favour of the soft instruments for all strictures. But, in spite of his high authority, I prefer the steel dilators for strictures of a higher calibre.

The objection to the steel dilators for tight strictures is the readiness with which they can damage the urethra, and it is surprising how little force is necessary to make a false passage with one of these instruments. But those, who are accustomed to use them for all strictures, prefer them, because their points are much more easily controlled than those of the soft bougies. If, however, steel dilators are used for tight strictures, conical instruments, such as the Buckston Browne dilators, should be used, and not Lister's or others, which have a bulbous extremity. But all those practitioners, who are only occasionally confronted with a difficult stricture case, would do well to use the soft bougies at the beginning of the treatment, because they are, in unskilled hands, easier to pass, and less likely to damage the urethra than the metal instruments.

When once the stricture has been dilated to 7 E., the steel dilators are to be preferred, because it appears that they are the more effective, and that dilatation is more rapid and more effectively maintained by them. Some patients very much prefer them, and feel that they do more good than the soft ones; others again, who are liable to rigors after urethral instrumentation, find that they occur far less frequently after they have been used. A gentleman, under my care, with a resilient stricture, which only admits a No. 6 E., finds that, after using a soft bougie, there is so much reaction that he may actually have retention at the end of twenty-four hours, but when the steel dilators are passed, though there is a little reaction, it is very slight and of no importance.

For general use, the English or French woven bougies,

with olive tips, are most satisfactory, though for strictures, which only admit a very small instrument, conical bougies, without the olive tip, should be used. In selecting bougies with olive tips, it is of great importance to see that the neck supporting the bulb is soft and pliable, so that it readily bends when pressure is applied to the tip. This is a quality which is frequently wanting in English bougies, but it should always be insisted upon, as the flexibility of the neck enables the bougie to find its way round various obstructions and enter the bladder with ease, in cases where one with a rigid neck might meet with difficulty. In fact, I am inclined to think that these stiff-necked bougies have been responsible for many false passages, which might have been avoided had a soft-necked instrument been used. The shaft of the bougie should be firm and fairly rigid; some instruments are so soft that they are of very little use for dilating purposes. For routine work, bougies, which are soft at the neck and in the adjoining third of the shaft, but rigid in the remaining two-thirds, are excellent, for while they are pliable, where pliability is desirable, they are rigid in the shaft beyond, and so enable the operator to use a reasonable amount of power in passing the bougie through a stricture without the instrument doubling up.

Unfortunately, the vast majority of soft bougies cannot be boiled, so that other means of effective sterilisation must be sought for. A simple and convenient method is treatment by formalin vapour. Immediately after use, the instruments are thoroughly washed with soap and water, and carefully dried. They are then placed in a glass or metal case containing a tablet of formalin, where they are kept until required. Just before use, the bougie may be wiped over with a swab, moistened with a weak solution of carbolic.

An alternative method is to place them in a solution of 1 : 1000 perchloride of mercury for six hours, after thoroughly washing with soap and water; they are then dried, and placed in a sterilised towel until required.

Many surgeons, however, are content with soap and water alone, but there is always a danger of setting up a slight catarrh of the vesical mucous membrane, especially in the case of a virgin bladder and urethra.

The fear of a possible cystitis is not the only reason for surgical cleanliness; rigors, according to one school, are always the result of septic absorption, so that, in order to prevent

them, every precaution must be taken to secure aseptic instrumentation. At the same time, it is held by many that while, of course, they may be the result of sepsis in some cases, in others, the rigor is a purely reflex-nervous condition. This would appear to be borne out by the fact that some men are much more liable to have them than others, and also that a rigor is more likely to follow the first instrumentation than any subsequent one. The French and Irish races, and men with a highly artistic temperament, are especially prone to suffer from this most unpleasant sequela, and the more roughly they are handled the greater the probability that one will occur.

Rigors then must be avoided, first of all by gentle treatment, and, secondly, by careful attention to surgical cleanliness, not only of the instruments to be passed, and of the hands of the surgeon, but also of the anterior urethra by means of irrigation ; for, in many cases of stricture, there is a urethral discharge, and also the anterior urethra normally contains a large number of micro-organisms. Urotropine may be given at the time, 10 grains in a tumblerful of hot water, with two further doses of 7 grains at intervals of six hours ; or a solution of silver nitrate, 1 : 1000, as suggested by Keyes, may be instilled into the urethra at the close of the sitting.

Some patients, who are liable to rigors, escape them, if the instruments are passed in their own home, so that they can go to bed, or stay in one room afterwards, and are not exposed to draughts or variations in temperature.

Impermeable strictures are those, in which part of the urethra has actually been obliterated, and all urine escapes from fistulæ in the perineum, or body of the penis, and none from the external meatus. All other strictures, provided that some urine passes the whole length of the urethra, are known as permeable strictures, for, if urine can pass out, a very fine instrument, *i.e.*, a filiform bougie, can pass in, though it may require much patience and perseverance on the part of the operator.

Various devices have been adopted in difficult cases, such as attempting to introduce the bougie while the patient passes water, filling the urethra with oil, illuminating the face of the stricture and passing the bougie with the aid of the urethroscope, and filling the urethra with filiform bougies, and then trying them in turn until one is found which will enter the stricture. The fact that the orifice of the stricture, instead of lying in the long axis of the urethra, often lies above or below,

or to one side of it, presents a difficulty which may be overcome in various ways. A simple expedient is the use of bougies, whose point is not in a straight line with the shaft; thus, the end may be corkscrew, or bayonet-shaped, or its end may be flexed at several points so as to form a zigzag. In any one of these ways, the tip is not in a straight line with the shaft, and so will more easily enter the orifice of a stricture, which is not at the centre of the lumen of the urethra.

Continuous dilatation is chiefly employed in very tight strictures, when the filiform bougie has been passed with great difficulty, and though, in these cases, internal urethrotomy is a more rapid method, continuous dilatation gives very satisfactory results.

The bougie is passed through the stricture and tied in. On the second or third day this is replaced by a larger instrument, and when this is removed one or two days later, treatment by intermittent dilatation can be commenced. Some patients, however, do not tolerate the retained instrument well, as it is liable to set up considerable vesical irritation and spasm, and, in some cases, urethral fever, and even rigors. Morphia, gr. $\frac{1}{4}$, given hypodermically, will often be a great help, but sometimes it is necessary to withdraw the bougie, and abandon all attempts at continuous dilatation.

In the treatment of stricture by dilatation, confidence, perseverance, and gentleness are of the greatest importance; the surgeon should not only feel confident that he will succeed in passing an instrument through the stricture, but he should endeavour to share this confidence with his patient.

Too much stress cannot be laid on the gentleness with which a stricture should be approached. The urethra is not only a very delicate structure, but an extremely sensitive one, and there are few things which a man forgives less readily, and remembers more clearly, than rough treatment which has hurt him and made him bleed.

The majority of the lacunæ and follicles, in which the instrument is liable to catch, lie in the floor of the urethra, and it is there that the majority of false passages are found. A common situation is in the bulb, where the urethra turns up into the membranous portion through the triangular ligament, and it is very easy for the point of the bougie to enter a pocket here instead of following the normal curve. These pitfalls can generally be avoided by hugging the roof with the point of the instrument; this is easily done with steel dilators, and the

woven bougie can generally overcome the difficulty, if its neck is given a slight upward curve. Gentleness is also called for, since anything like force may not only cause urinary fever, but frequently does cause a reactionary contraction twenty-four hours later, and in the case of a tight stricture, this may mean an attack of retention of urine.

Strictures vary very much, not only in their form, but also in their tolerance of treatment, for some will submit to an amount of stretching, which would excite considerable resentment in others ; so that each case must be treated on its merits.

In conclusion, dilatation is the treatment, above all others, which is to be recommended in the great majority of cases of stricture of the urethra. Impermeable strictures, of course, cannot be treated in this way, and resilient strictures, and those which cannot be dilated to a proper extent, and, lastly, those cases in which fever, or rigors regularly follow any attempt at dilatation, are exceptions to this general rule ; they are best treated by urethrotomy, either internal or external, or by the two combined.

(*d*)—The Treatment of Acute Gonorrhœa.

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The treatment of acute gonorrhœa falls naturally into two distinct methods, the abortive and the expectant. In considering the treatment to be adopted, it is necessary to bear in mind a few simple anatomical details, and in connection with them, the mode of spread of gonorrhœal infection of the urethra.

Clinical Anatomy of the Urethra.—For clinical purposes, the urethra should be divided into two portions, the anterior and the posterior. The former comprises that portion of the canal anterior to the lower layer of the triangular ligament. It is in part pendulous and in part fixed, consisting of the penile and perineal portions. This part of the urethra presents both the narrowest and the most expanded portions of the canal, namely, the external meatus and the bulb, and into it open the mouths of the glands of Littré, the urethral follicles, and the ducts of Cowper's glands, the last passing through the inferior layer of the triangular ligament to open in the floor of the bulb.

The posterior urethra consists of the membranous portion, lying between the two layers of the triangular ligament com-

pletely surrounded by the compressor urethræ muscle, and the prostatic part of the canal. Into the latter open the common ejaculatory ducts, and the ducts of the prostatic follicles.

This division of the urethra is of clinical, as opposed to anatomical, importance, for the compressor urethræ, in the great majority of cases, shuts off the posterior from the anterior urethra very effectually, so much so that a considerable pressure is sometimes necessary to effect an entrance, if the muscle is contracting strongly. The treatment of gonorrhœal urethritis depends upon the limitation of the infection to the anterior urethra, or its spread along the whole length of the canal.

Mode of Infection and Spread.—In the very early stages of infection, the inflammation is limited to the most anterior part of the urethra, namely, the meatus and the first inch or so of the canal.

If a patient presents himself within a few hours of the first appearance of irritation and stickiness of the mucous membrane, an urethroscopic examination shows a sharp limitation of the inflammatory condition to this portion of the tract, the urethral mucous membrane being engorged and reddened in front, but of the usual pale pinkish tinge a little farther back. But the backward spread of the infection is rapid, and, within two or three days of the onset, the area of inflammation creeps along the urethra into the bulb. Here, in many cases, the process is arrested, and a simple anterior urethritis alone results.

But, in a considerable proportion of cases, the infection proceeds further, passes the compressor urethræ, and the posterior urethra falls a victim.

Treatment should be adopted, in the first instance, in order to prevent this backward spread of infection wherever possible, and, when posterior infection has occurred, to confine it to the urethral canal and save the seminal vesicles, vasa deferentia, and epididymes from the march of the disease.

The Abortive Method of Treatment.—When the patient presents himself in the very early stage of the disease, it is quite possible, in many cases, to cut short the urethritis at once. This is effected by the application of strong antiseptic solutions to the infected mucous membrane, but it must be noted that the method is only likely to give good results, if the case is seen within a few hours, or at most a day or two of the onset of the symptoms, and before a free purulent discharge has made its appearance. It is unfortunately but seldom that a

patient, infected for the first time, presents himself so early for treatment either in hospital or private practice. The best field for this method is undoubtedly in the naval and military services, where the patients are encouraged to report infection at once, and are punished for a concealment of their condition. But both hospital and private patients should be instructed that, if ever they incur another infection, they should seek medical aid immediately with a view to aborting the condition.

In order to apply the abortive method the patient should first pass urine.

The first 2 or 3 inches of the urethra should then be washed out with sterile water, either by means of the urethral irrigator (*vide infra*), or by a syringe with a capacity of 2 ozs. or more. The surgeon must limit this washing to the anterior part of the canal by compressing the urethra in front of the scrotum.

The urethra should then be anæsthetised by the injection of a solution of cocaine, eucaine, or novocaine. The writer prefers the last, as its action is more rapid than that of eucaine, and decidedly less toxic than cocaine. Novocaine in 2 per cent. solution is amply sufficient for the anæsthesia required.

The largest sized urethroscope tube, that will pass without splitting or tearing the mucous membrane, is then introduced, and the posterior limit of the infection, as evidenced by the redness and congestion present, is ascertained. From a little behind this limit right forward to the meatus, the mucous membrane is then painted with a solution of silver nitrate of a strength of from 2 per cent. to 4 per cent., great care being taken that no smallest part of the surface escapes the application of the silver. The excess of silver solution is mopped up by pledgets of wool upon holders, and the tube withdrawn. A small irrigation or syringing with salt solution follows, and the treatment is completed. The patient should report the following day, and if the urethra appears quiet, it should be washed out with a little salt solution.

Forty-eight hours after the first application, the process should be repeated exactly in the same manner, and once again, after a further interval of 48 hours. If the treatment is going to be a success, nothing but a little sticky mucus will show itself, in which no gonococci can be found, though there are plenty of epithelium and a few leucocytes, and no further symptoms will develop.

By those, who are not provided with an urethroscope, the treatment may be carried out by injecting a solution of the same strength for the same distance into the urethra, holding it in for from two to four minutes, and then neutralising with the saline solution as before, but great care must be taken not to inject the solution beyond the penile urethra, *i.e.*, it must not go further back than the peno-scrotal angle.

The abortive treatment should invariably be carried out by the practitioner, and never entrusted to the patient.

In the writer's hands, this method has met with good success, but only in those cases, as already stated, where the discharge had not become thickly purulent, although the gonococci were present in huge numbers in the sticky muco-pus expressed for examination.

In connection with this abortive method, it is interesting to note that, in certain foreign services, *preventive* treatment is adopted. Liberty-men from ships or barracks are provided with a small case containing two collapsible tubes filled with petroleum jelly or similar medium, with which is incorporated from $\frac{1}{2}$ to 1 per cent. protargol. The tubes terminate in nozzles, suitable for introduction into the meatus, and are fitted with metal caps.

The men are instructed to remove the cap, and squeeze the contents of the tube into the urethra, after each sexual intercourse. In addition to the protargol tubes, a tube containing a mercurial cream is also supplied, and the men are directed to thoroughly rub this cream into the glans penis and prepuce, with the object of preventing syphilitic infection.

The medical officers report that, since the introduction of these precautions, the admissions for venereal infections have shown a marked decline.

It is more than doubtful, however, if public opinion in this country, which is unable to swallow the Contagious Diseases Acts, would sanction the enforcement of these precautionary measures.

Modified Abortive Treatment by Irrigation.—When the disease has progressed beyond its merely initial stages, and a free purulent discharge is present, with evidence of infection of the bulb, but the process is still limited to the anterior urethra, systematic irrigation, in a certain number of cases, unquestionably shortens the duration of the attack, and, moreover, conduces very much to the patient's comfort.

For success to attend the method, it is essential that the

patient should be prepared to attend twice a day for at least ten days consecutively, and in some cases some days longer.

For the administration of urethral irrigation very few instruments are required.

An irrigator can, holding a quart or more of solution, fitted with six or seven feet of rubber tubing and an easily manipulated stop-cock, should be suspended from three to four feet above the patient, who may be either in a recumbent position, or sitting on the edge of a chair with the legs apart.

The best form of nozzle is that known as Wyndham Powell's, which is fitted with a glass bell to prevent spurting of fluid over the patient or operator.

The patient should first pass urine. The operator should then draw back the prepuce, and thoroughly cleanse it and the glans with pledgets of wool soaked in perchloride of mercury solution, 1—5000.

The penis should then be grasped with the left hand, and the irrigator nozzle taken in the right hand. The stop-cock should be opened, and the rubber tube compressed between the fingers of the right hand, thus regulating the flow to a nicety.

The glans and prepuce should be washed over with a little of the solution, and then, the meatus being opened with the left thumb and forefinger, the lips should be washed ; gently introducing the nozzle into the meatus, the flow should be allowed to slightly increase in force, and, as the nozzle is introduced a little further, its blunt conical shape blocks the meatus, and the anterior urethra is felt to balloon under the pressure of the fluid by the fingers of the left hand holding the penis. The pressure of the fluid must not be great, for, if it is, the compressor urethræ will be forced, and some of the fluid will find its way into the posterior urethra.

By alternately inserting and withdrawing the nozzle a little, the urethra is alternately ballooned and collapsed as far back as the bulb. About a quart of solution, at a temperature of 100° F., should be used at each sitting.

The writer uses a solution of permanganate of potassium in the following strengths :—

1st day	Morning - 1—5000 Evening - 1—5000	3rd day	Morning - 1—4500 Evening - 1—4000
2nd „	Morning - 1—4500 Evening - 1—5000	4th „	Morning - 1—3500 Evening - 1—3000

5th day	Morning - 1—2500 Evening - 1—2000	8th day	Morning - 1—1000 Evening - 1—1000
6th „	Morning - 1—1500 Evening - 1—1000	9th „	Morning - 1—1000 Evening - 1—1000
7th „	Morning - 1—1000 Evening - 1—1000	10th „	Morning - 1—1000 Evening - 1—1000

By about the morning of the fifth day, in a great many cases, the discharge is represented only by a thin muco-purulent drop, and the scalding pain on micturition has disappeared. By the seventh or eighth day, the meatus appears dry, and in cases, which are going to be successful, no further discharge appears. It is well to have as long an interval as possible between the daily irrigations, the patient should, therefore, come at nine in the morning, and between six and seven in the evening.

The strengths of solution, given above, are usually well tolerated, but, if they cause undue smarting and burning in any given case, they must be somewhat modified. It is important that the utmost gentleness should be used, and that the urethra should never be forcibly "ballooned" by the irrigation.

At the close of the course, the patient should be instructed to report in forty-eight hours whether any discharge shows itself or not, and, if it does, the urine should be sedimented and examined for gonococci at intervals of a few days, for a fortnight or so. If the discharge recurs at the close of the course of irrigation, it is not always due to the presence of gonococci. It should be remembered that a gonorrhœa is seldom a pure infection with gonococci, but that other pus-producing micro-organisms are usually present, and it sometimes happens that a recurrence of discharge shows no gonococci at all. In such cases, a very weak perchloride of mercury solution (1–20,000 to 1–15,000) should be used for irrigation every other day, once a day, for about ten days.

But if, in a recurrent discharge, the gonococci are still present, it is better to undertake a further course of permanganate irrigation on the same lines as previously. During the course of irrigation, exactly the same general treatment, and the same prohibitions are enforced as in the expectant treatment (*vide infra*).

The results of this modified abortive treatment by irrigation are varied. In many cases, they are altogether admirable.

The disease is cut short, the patient is kept in great comfort throughout the treatment, and spread of the inflammation to the deep urethra is obviated.

But in a certain proportion of cases, although the urethra is perfectly comfortable throughout the course, and, although all discharge disappears in three or four days from its commencement, the discharge slowly reappears a few days after the cessation of irrigation, even though the patient may not have missed one attendance and may have carried out the surgeon's instructions scrupulously. It is, therefore necessary to inform patients of this fact, and not to hold out too glowing promises of certain and rapid cure.

Finally, after each irrigation, a little salicylic or biniodide of mercury cotton wool should be placed over the end of the penis, or the penis should be inserted in a loose gonorrhœa bag, at the bottom of which the wool is placed, and should be changed at each micturition so as to avoid autoreinfection by the discharge.

Expectant Treatment.—When the patient is unable, or unwilling, to undergo the irrigation treatment, and appears with an acute anterior urethritis fully established, the case must be treated upon expectant principles. In the first place, scrupulous cleanliness must be insisted upon. An antiseptic lotion should be supplied with which the penis, prepuce, and glans should be bathed, after micturition, as often as possible. Solutions of perchloride of mercury 1—5,000, lysol ½—1 per cent., chlorinate of soda 1—60, and the like are the usual and useful formulæ. After each micturition, a fresh piece of antiseptic wool should be applied, as recommended in the previous section.

It is well to immerse the whole penis in the hot lotion twice or three times a day for five or ten minutes.

Meat diet should be relinquished in favour of fish, eggs, milk, and cereals, and all highly spiced and seasoned dishes must be avoided.

Alcohol is absolutely contra-indicated in any method of treatment of gonorrhœa, and it may here be stated that alcohol should not be allowed in any form, until at least three weeks have elapsed without any sign of urethral discharge.

The patient should be placed upon a diuretic water, such as those of Contrexéville, Wildungen, or Vichy, so that a free flow of urine may be encouraged.

The urine too should be rendered alkaline, the gonococcus

living in acid media, by the exhibition of alkaline drugs, with which should be incorporated some form of urethral sedative.

A useful prescription is the following :—

℞ Potass. Bicarb.
Potass. Citrat. - - - - - āā gr. xx.
Spirit. Ether. Nitrosi - - - ℥xxx.
Tinct. Hyoscyami - - - - ℥xxx.
Infus. Buchu - - - ad ℥j.

To be taken every four hours.

The urethritis passes from a free liquid yellow to a still more copious, thicker, yellowish-green, and, finally, blood-stained discharge in bad cases, and then slowly subsides again. It is when the most acute stage is passed that the exhibition of the balsams is of most service. The writer considers that, in the stage of free thick discharge with pain, scalding micturition and chordee, such drugs as copaiba, sandal-wood oil, and their like should be avoided, reliance being placed upon free diuresis and alkalis.

But when that stage is reached where pain is diminishing or has ceased, and scalding on micturition is disappearing, the balsams are of the greatest service.

Of these, sandal-wood oil, and preparations containing this drug are far better than copaiba. Sandal-wood oil should be given in capsules containing ten minims four or five times a day.

Occasionally, patients cannot digest sandal wood oil, and then "santyl," "gonosan," or "santal-midy" may be substituted for it. These drugs should be given in rather larger quantities, for, on the whole, they are not quite so efficacious as the pure santal oil.

It is at this stage in the case, too, that anterior urethral injections may be prescribed with advantage, and here the writer would enter a strong protest against the indiscriminate use of urethral injections in acute gonorrhœa. In his opinion, injections should never be used by the patient until the really acute stage of the disease is passed, and micturition is unattended by real pain.

The patient should be instructed to pass urine, then very gently to insert the nozzle of the syringe, and equally gently press home the piston. A syringe with a capacity of one fluid ounce should be used. As soon as the urethra feels full, the patient should remove the syringe, and retain the injection for

a minute or two by compressing the lips of the meatus. It cannot be too strongly urged that no force whatever must be used, as by neglecting this warning, the injection may be forced into the posterior urethra, where it is not wanted, and may do harm ; indeed it is not too much to say that a considerable number of infections, which would have remained confined to the anterior urethra, have been spread by improper injections into the membranous and prostatic urethra.

If the patient can attend two or three times a week, it is certainly of service to give irrigation with solution of permanganate of potassium, although an abortive effect upon the urethritis cannot be anticipated. But irrigation once or twice a week is a comfort to the patient, and helps to shorten the duration of the disease. Unless the full irrigation treatment is to be carried out, the writer considers that it should not be used at all, until the most acute symptoms have subsided.

Acute Posterior Urethritis.—Acute posterior urethritis may be of very mild degree, or of the most fulminant type. The symptoms are so familiar that it is only necessary to mention them. A continuous dull aching in the perineum and rectum, increased frequency and pain of micturition, tenesmus, and if the swelling of the mucous membrane is considerable, difficulty of micturition varying from slight slowing of the stream to complete retention, form a picture which cannot be mistaken.

In acute posterior urethritis, the patient should always lie up. It is most undesirable that he should walk at all.

Hot hip-baths should be taken twice a day, and the patient should sit in them for from 15 to 20 minutes.

If the symptoms are very acute, two or three leeches to the perineum are of service, whilst copious hot enemata not only unload the bowel, but are of considerable service in relieving the aching pain.

The patient should be freely purged, and the other medicinal treatment follows the lines already laid down for acute anterior urethritis. If the pain is really severe, morphia in the form of suppositories of gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$ should be given sparingly.

In the very acute forms, the writer has had some success from the administration of sandal-wood oil combined with alkalis in the form of an emulsion, although, in the acute anterior variety, the balsams do not appear to exert their best effect until the worst symptoms are subsiding. Santal oil in capsules does not appear to be of much use, but the following

formula has often proved of service:—

℞ Ol. Santal Flav. Puriss. - - ♏xv.
Potass. Bicarb. - - - - gr. xxx.
Salol - - - - - gr. v.
Pulv. Acaciæ - - - - gr. xxx.
Essent. Menth. Pip. - - - ♏iij.
Aq. - - - - - ad ℥j.

M. Ft. Emuls.

S. To be taken three or four times in 24 hours.

When taken in this form, the elimination of santal by the urine is remarkably rapid. Irrigation is absolutely contra-indicated in acute gonorrhœal infection of the posterior urethra, and, although it is permissible to wash out the anterior urethra very gently, the writer on the whole prefers to do without any local measures until the worst symptoms have subsided.

Vaccine Treatment of Acute Gonorrhœa.—The treatment of gonorrhœa by inoculation must be mentioned, but cannot be entered into in a paper of so limited scope. It must suffice to say that, both in very extensive gonorrhœal infection, with generalised infection of joints, eyes, etc., as well as in some of the more obstinate chronic types of infection, the writer has seen sufficient success result to warrant a more extended trial of this method.

(*e*)—Gleet: Some Points in its Diagnosis and Treatment.

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Gleet was formerly regarded as a tiresome chronic complaint almost impossible to cure. Now, thanks to modern surgical science, by means of careful diagnosis and treatment, this condition, in the large majority of cases, is curable. Gleet is a symptom of many pathological conditions. By the word gleet, we mean a constant discharge of a small amount of fluid—pus, muco-pus, or mucus—from the urethra. Extreme care is called for in diagnosing the cause of this symptom. The discharge is produced in (*a*) anterior urethra, (*b*) posterior urethra, (*c*) vesiculæ seminales, (*d*) Cowper's glands.

By anterior urethra is meant that portion, which lies in

front of the compressor urethra ; the posterior urethra includes the membranous and prostatic portions.

Chronic Urethritis.—Physical signs and symptoms :—

I. *Discharge.*—The discharge may vary considerably in amount, though it is usually very small, consisting only of a single drop, observable on the patient waking in the morning, or it may be so small as to only stick the lips of the meatus together. The colour may be yellow, grey, white, or perfectly clear.

II. *Urine.*—The patient should be desired to pass the urine into three or four glasses. In the *first* specimen, consisting of one or two ounces, the urine will be cloudy, containing flocculi or threads of varying types. It is from the *second* specimen, consisting of five ounces of urine, that a differential diagnosis between anterior and posterior urethritis is made. In the former case, the urine is almost or quite clear, with very few flocculi, and it will naturally follow that the third and fourth specimens will be absolutely clear and bright. In the latter case (posterior urethritis), the *second specimen* will be cloudy, and contain flocculi less in degree than the first, and the third and fourth specimens will also be cloudy, and contain flocculi ; the whole contents of the bladder being soiled by the backflow of inflammatory products of the posterior urethra. Some authorities state that, if the last specimen of urine is more cloudy and soiled than the penultimate, cystitis is indicated, but the author cannot agree with this view. If the urine in the last specimen is more cloudy, and contains larger flocculi than the penultimate, this excess is probably caused by the final contractions of the muscles surrounding the posterior urethra having squeezed out purulent secretion from the walls of this canal ; but if, on the other hand, gross masses of muco-pus are found in the last specimen, this indicates a general cystitis, and not the small amount of inflammation of the adjacent vesical cervix, usually found in posterior urethritis.

Confirmatory Methods of Diagnosis of Posterior Urethritis. —(1) The anterior urethra can be irrigated with saline solution until the outflow is prefectly clear. All cloudiness and flocculi, found in the urine, must then come from the posterior urethra or bladder.

(2) Irrigation of the anterior urethra with permanganate : any flocculi, which are unstained, must come from the posterior urethra.

(3) An injection of methylene blue or permanganate of potash into anterior urethra retained for a few minutes: if there are many flocculi unstained, posterior urethritis is present.

All these tests must be applied before micturition.

Flocculi.—(*a*) A large solid yellowish-white coagulum, sinking at once, indicates a largish area of sub-acute urethritis still existent.

(*b*) Many small long yellowish particles, some floating, some sinking in the urine, indicate inflammation of lacunæ and mucous glands, a variety of urethritis peculiarly amenable to frequent irrigation, posterior or anterior, as the case may be.

(*c*) Long slender grey flocculi, in which are found much epithelium, indicate a healing condition. Local measures should be curtailed or diminished in strength. This flocculus is practically a small cast of the urethra; the epithelium is of many varieties, shapes, and sizes; that from the anterior urethra generally consists of spheroidal cells with large nuclei, separate, or in flat masses, or of very large epithelia from the meatus urinarius and fossa navicularis. Very often torpedo-shaped cells, arranged in a long end-to-end ribbon, are seen, the significance of which is difficult to understand. They are not transitional epithelium from the bladder or prostate, as they can be washed out of the anterior urethra by irrigation.

(*d*) A filmy grey floating flocculus, with tiny white spots in it, which shows, under the microscope, loose pus cells, angular cells, and small or large epithelia, indicates a healing patch of superficial catarrh. The looseness of the cells is characteristic.

(*e*) A single long three or four inch flocculus, which can be drawn out on a slide, is sometimes seen. On closer examination, this flocculus will be observed to have, at one end, a root, yellow in colour, of a thicker and more solid consistency. This suggests suppuration of one follicle, which, in its discharge, causes the infection of a considerable length of urethra.

(*f*) A number of small coagulated white masses are often evacuated in the urine of a patient with stricture, or indurated patch; large flattened squamous cells are often seen in these cicatricial conditions.

(*g*) An infinite number of diminutive flakes, bearing a close resemblance to the tissue of a fly's wing, float in the urine. These, under the microscope, are found to be epithelium, and are generally due to strong injections in a healthy urethra. (Much more might be said on this interesting subject

of "flocculi," but the limited space of this article precludes further discussion at present.)

Extreme care should be exercised to procure the right quantity of urine for the first specimen taken, because, in the case of a gleet with very little discharge, should five ounces be taken instead of the proper one or two ounces, the important cloudy appearance may be missed; for perfectly bright, clear urine, containing a few small flocculi with much epithelium, generally means that a certain gleet has recovered so far as it is likely to do, but the presence of cloudiness indicates a definite amount of activity in the disease. It must be remembered that the specimens of urine for examination should be taken on rising in the morning (that being the termination of the longest interval of retention), and in the presence of the surgeon; further, that flocculi dissolve in urine on standing, and the centrifugalised results are unsatisfactory.

The method of passing urine into several glasses is very useful, but by no means absolutely accurate, for muco-pus is extremely sticky, and is not necessarily all washed out by the first outflow of urine, especially if the meatus is large, and the expulsive force deficient. It is also a well-known fact that, on the first day of the purulent discharge in acute gonorrhœa, each specimen of urine is very cloudy, with a large deposit of pus, although the pain and tenderness are localised to the anterior two or three inches only, and then, after three days' treatment or less, the last specimen will be quite clear. It is impossible to think that acute posterior urethritis has started and cleared up in so short a time.

III. *Palpation of the Urethra.*—In forming a diagnosis, the surgeon should carefully feel along the whole length of the anterior urethra externally, and, by passing the protected finger into the rectum, examine the prostate and vesiculæ. After some practice, it is possible to feel externally (*a*) a thickening of the corpus spongiosum, indicating a stricture, (*b*) folliculitis or follicular abscess, (*c*) intra-urethral chancre, (*d*) gumma of the peri-urethral tissues; the last being a more common condition than is generally thought. In the rectum, various pathological conditions of the prostate and vesiculæ can be felt, but these diseases, except chronic spermato-cystitis (see below), lie outside the scope of this paper.

IV. *Passage of Instruments.*—An acorn-headed, or olive-headed bougie, or some form of urethrometer (Kollman),

hould be passed in order to diagnose stricture, and the presence of scar-tissue formations and infiltrated patches in the wall. *See* Bougies.

Symptoms.—Those of *anterior urethritis* are a negligible quantity. There is generally very little discomfort in *posterior urethritis*. A little tingling, burning, shooting pain in the deep urethra at the neck of the bladder, in the rectum, perineum, or reflected to the tip of the penis, may be experienced. Some increased frequency of micturition, nocturnal emissions, and an occasional spot of blood may also be observed.

Chronic prostatic urethritis is undoubtedly the cause of the majority of prolonged gleets. This is due to the many crevices, sinuses, follicles, and glands found in the prostate. It is not surprising that a pyogenic process in this canal is prolonged, and difficult of cure.

Posterior urethritis being already diagnosed, at the patient's second examination in order to diagnose prostatic urethritis, let him pass about three-quarters of his urine, retaining the remainder; then pass a protected finger into the rectum, massage the prostate firmly in a downward direction. If, during this process, secretion flows to the meatus, examine it microscopically; next get the patient to pass the remainder of his urine, which will be found to be more cloudy, and contain more flocculi than the other specimens. The microscopic examination of the secretion and of these flocculi will show many pus cells, a few blood cells, much prostatic epithelium, spermatozoa, and some small round highly refracting bodies.

Spermato-cystitis.—In examining the prostate, thickening of one or both vesiculæ seminales may be felt, and, on massaging them, a thick lard-like secretion is found floating in the urine. This secretion sometimes contains spermatozoa, (from the vasa deferentia) and, if there is pus, or blood cells, spermato-cystitis is present.

TREATMENT.

General Treatment.—The usual dietary ordered in urethral cases should be followed, accompanied by rigid abstinence from the use of alcohol. Great care should be used as to the perfect cleanliness of the parts affected. Very little exercise must be taken, and the bowels must be kept freely open.

For a true gleet *internal remedies* are of very little use, but for sub-acute urethritis they are of considerable value. Sandal-wood oil, Kharva-Kharva, cubebs are the most useful;

the point in their exhibition being that large quantities are often effective when smaller doses fail. The newer drugs, urotropine, hetraline, helmitol, are useless in gleet.

Local Treatment.—For *anterior urethritis* irrigation is a most useful treatment. Apparatus required :—(1) large douche reservoir, (2) long india-rubber tube with a clip at its distal extremity, (3) Y-shaped glass tube, connected by one of its bifurcations to the rubber tube.

Method.—The glass nozzle (*a*) is carefully made red-hot to sterilise it. The reservoir is filled with a quart of antiseptic fluid at a temperature of 100°. Many drugs are used, but of these permanganate of potash is the best ; strength from 1–6000 to 1–1000, certainly never stronger than this. The patient is then placed lying on a couch with a Barnes' receiver between his legs to catch the escaping fluid. The prepuce, meatus, and glands are then *thoroughly* douched, the nozzle (*a*) is then placed in the urethra, and pressed gently home ; now, by placing the finger on the exit tube, the fluid is driven by gentle jerks further and further along the urethra, the patient being told to contract the compressor urethræ. This treatment should be applied every third day, or more or less often, as improvement or otherwise ensues.

Concurrently with this treatment, the patient should use twice or thrice daily, as directed, a solution of sulphate of zinc (gr. i.), sulphocarbolate of zinc (gr. ij.), or permanganate of zinc (gr. $\frac{1}{8}$), by means of a *half-ounce* syringe, which it will be necessary to teach him to use. If the discharge ceases, and the urine is clear, gradually discontinue the irrigations, but continue the injections until cured. If, on the other hand, there is no improvement, Guyon's method of treatment should be applied to the anterior urethra only (*see* Guyon's method).

Posterior Urethritis.—Irrigate the anterior urethra in the same way, using half the fluid only. Now the surgeon closes the exit tube, thus allowing the fluid to fully distend the anterior urethra (height of reservoir 3 or 4 feet). At this point, the patient must be told to essay micturition against the irrigation, and to take long deep inspirations. By these means, and the use of a hot solution, the author has never failed to fill the bladder in a few minutes. The process is completed by the patient emptying the bladder.

If no improvement is observed under this treatment in two or three weeks, the surgeon will have recourse to stronger

drugs, in smaller quantities, by means of Guyon's or Ultzman's apparatus.

Guyon's Method.—A syringe being filled with silver nitrate (5 grains to the ounce), a slender *acorn-headed* catheter, lubricated with a little glycerine, is passed as far as the compressor urethræ, then through its grip into the posterior urethra; it is then pulled back to confirm the grip, repassed about one inch beyond the grip. Next gently expel about one half (30 minims) of the fluid into the posterior urethra, withdrawing the catheter at the same time, and continuing to withdraw. The remaining 30 minims must be injected into the whole length of the anterior urethra. While this injection is being effected, it will be wise to compress the lips of the meatus in order to prevent any escape of the fluid. This is the most successful of all treatments for posterior urethritis. It is followed by some pain, and a desire to micturate, which may be permitted as soon as the injection is completed. This treatment should be repeated every fourth day, after the reaction has entirely ceased. (In anterior urethritis only this portion is instilled with the silver nitrate.)

It is perhaps unwise to make use of ordinary injections concurrently with Guyon, though some surgeons do not hold this opinion.

In *Prostatic urethritis,* before the preceding antiseptic methods (irrigation and instillation) are exhibited, the prostate and vesiculæ are thoroughly massaged with the protected finger, or a suitably-shaped instrument; the author prefers a finger. This pressure empties the follicles, and renders them patent to the action of the antiseptics.

Where the urethrometer or bougies have found *cicatricial contractions,* indicating the formation of fibrous tissue in the deeper urethral tissues, these constrictions should be gradually and fully dilated by means of steel sounds, if the meatus is of good size. If the urethral orifice is small, this dilatation should be effected by Kollman's dilator. Dilatation is immediately followed by irrigation or instillation of antiseptic fluids (*vide ante*).

Treatment through the Urethroscope.—Through a Luy's urethroscope (direct illumination), the most perfect yet invented, localised soft red areas, which easily bleed, and indurated areas may be touched with silver nitrate or pure carbolic acid; warts may be excised, or abscesses opened, immediate cure being sometimes effected.

A REVIEW OF RECENT WORK ON EPIDEMIC CEREBRO-SPINAL MENINGITIS.

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THE recent appearance, both in Europe and in America, of cerebro-spinal meningitis, in its epidemic form, has done much to add to our knowledge of this very obscure infection. We are now, thanks to the discovery of the diplococcus intracellularis by Weichselbaum, and to the more general application of lumbar puncture as a means of diagnosis, in a much better position to learn something about the exact nature of the origin and propagation of the fever. On the other hand, recent advances in serum and vaccine therapeutics have greatly stimulated researches undertaken with the object of securing an effective treatment for a most fatal disease. When we consider that the case mortality in Glasgow and Edinburgh has reached over 70 per cent., it is obvious that there is much room for improvement in our present method of treatment. And yet even this mortality does not cover the damage done by the fever. Many of the survivors are left permanently blind or deaf, and others become affected mentally. It is a poor satisfaction to save the life of an infant, if it is to remain a deaf mute. Von Ziemssen noticed that the admissions to deaf and dumb asylums in Germany were greatly increased after the great epidemic wave of the disease in 1871, and, so far as can be judged at present, it seems as if our experience in Scotland to-day is going to confirm his observation.

One of the interesting points, raised by the appearance of the epidemic fever, is its relation to the cases of posterior basic meningitis, which we see from time to time in our children's hospitals. This question has been so fully and carefully discussed by Langmead, in the pages of this journal a few months ago, that it will be unnecessary here to do more than mention his conclusions. These, briefly, are that the two conditions are variations of one and the same disease. The bacteriological differences between the diplococcus described by Still, and

that of Weichselbaum are so slight that they represent a modification of characteristics, rather than a distinction in kind. Posterior basic meningitis, moreover, when studied in children above three years of age, presents a clinical picture which is, so to speak, half way between that of the disease in infants and that of the typical epidemic fever. A certain number, moreover, of posterior basic cases show vertical lesions, and no broad line of distinction can be laid down from a study of the pathological appearances. Lastly, basic meningitis can occur in epidemic outbreaks. Langmead found that most of his cases came from the same district, many from adjoining streets, and, occasionally, two cases came in succession from the same street.

Osler also has no doubt of the identity of the two conditions, which he regards as merely the sporadic and epidemic forms of the same disease, and it would indeed appear impossible to come to any other conclusion. But it would also seem certain that the diplococcus undergoes considerable modification before it can take on the epidemic form. Besides the very slight cultural distinction, it has been found that serum from sporadic cases does not agglutinate the diplococci of epidemic cerebro-spinal meningitis. Dr. Houston informed me that, whereas blood serum from epidemic cases in Edinburgh and Glasgow agglutinated diplococci from similar cases in Belfast, the latter failed to react with the serum from sporadic cases in London. Again, I am told by Miss Taylor that Edinburgh and Belfast blood serum failed to agglutinate the diplococci of the London cases. Dr. Robb, in the discussion on his paper at the recent meeting of the British Medical Association, stated that opsonic and agglutination experiments with the Belfast cocci showed them to be identical with those of New York, Glasgow, and Hamburg, but different from those of post basic meningitis cases.

These slight differences in apparently similar micro-organisms remind us that the bacteriology of cerebro-spinal meningitis is, in spite of the definite pronouncements of certain writers, extremely puzzling. It is not unusual to find Gram positive diplococci in cultures from the spinal fluid. The consensus of opinion is, of course, that the germ is Gram negative, but there seems to be no satisfactory explanation

of the appearance of the differently staining organism. Those who systematically work at the preparation of serums exclude all Gram positive strains, but, when these are obtained from the spinal fluid, it is surely possible that they may be partly responsible for the condition. The germs described by Jäger, in 1895, were Gram positive, and apparently were obtained from real cases. These micro-organisms failed to agglutinate with the serum prepared by Jochmann from Gram negative organisms. Another very interesting point is the relation of the diplococcus of Weichselbaum to the gonococcus. Ruppell found that there was a striking resemblance between the non-virulent strains of meningococci and ordinary gonococci, morphologically, culturally, and as regards their immunising power against virulent meningococci. These resemblances have led to heroic attempts to cause gonorrhœa by the inoculation of meningococcus cultures into the urethra.

Marcovich reports an interesting case, which was at first regarded as enteric fever, from whose blood he cultivated the meningococcus, when looking for the typhoid bacillus. The negative Widal and the subsequent course of the illness justified a diagnosis of cerebro-spinal fever, and an autopsy proved this to be the case.

Fraser and Comrie have investigated the epidemic in Leith, with special reference to the carriage of the infection by contacts. The work of Jehle had already gone far to prove that the disease is spread by third persons carrying the infection in the naso-pharynx. His theory, based on his experience of the epidemics in German mining districts, is that coal mines, from their darkness, heat, and moisture, afford admirable incubators for the growth of the diplococcus. Miners, moreover, who often suffer from chronic rhinitis and pharyngitis, and who are addicted to spitting, make good carriers of infection. Without taking the disease themselves, they readily communicate it to their children, either by direct contact, as in kissing, or by fouling drinking vessels, or the floor of their rooms by their pharyngeal secretions. In this way, the fever was found to spread among children, who had no connection at all above ground, but whose fathers worked in the same shafts. Fraser and Comrie noticed that a large number of the Leith cases occurred among the children of

dock labourers, and no less than five of the fathers of affected children were engaged in overhauling a particular ship in the docks. In the engine room of this ship, cultures of the meningococcus were obtained by exposing Petri dishes of ascitic agar. The conditions of labour in a hot, dusty, and ill-ventilated engine room, sufficiently closely resemble those in a coal mine to make this result extremely interesting when compared with those of Jehle. In all, the Leith observers examined the naso-pharyngeal secretions of 69 contacts, and were rewarded by isolating the meningococcus successfully in no less than 10 of them. Of these 10, it is interesting to learn that no less than 5 were fathers of patients, and, as in all only 15 fathers were examined, it seems clear that they harbour the germ in a much higher proportion to their numbers than do the other contacts. This certainly points to their being the source of infection, although they do not often contract the disease themselves. Fraser and Comrie conclude that it is advisable to examine the nose and throat of all contacts for the meningococcus, and to disinfect the naso-pharynx of those in whom it is found. The contacts should be isolated until two consecutive negative results are obtained.

The proportion of positive results, in an investigation of the same nature, was even higher in the series examined by Ostermann at Breslau. Out of 24 contacts, he succeeded in finding the meningococcus in as many as 17. He made use of the agglutination test with Jochmann's serum, a method of differentiation which was not used by the Leith observers, doubt having been cast on this method by Gordon, Dunham, and others.

THE SPREAD OF INFECTION.

The origin of the infection, its mode of transmission, and the best means of combating it are discussed by Robertson in an admirable paper. As Medical Officer of Health at Leith, he has been in a good position to make a careful study of the question. He points out that, in the Scottish epidemic, the towns which have suffered have either been seaports or in close connection with them. He believes that both Leith and Glasgow became infected by immigrants from the continent of Europe, or to speak more precisely transmigrants, as these

foreigners leave Leith immediately for Glasgow, where they may or may not stay a few days before continuing their journey to America. Polish miners, moreover, are employed in the Lanarkshire coal pits, and it is possible that immigrants of this class may have imported the infection, especially when one remembers the important part played by miners in the epidemics abroad. Robertson holds that, if the disease had been imported from America, Liverpool and Southampton would have suffered equally with Glasgow, and this certainly seems a strong argument in favour of the disease having come from the continent. He is strongly impressed with the fact that it is by the medium of contacts that the infection is spread, and regards the sufferer himself as being comparatively harmless. One of his first cases was notified as scarlatina, and lay for some weeks in the scarlatina wards without infecting any of the other patients. I may say that I have had a similar experience in a measles ward, which was, if any thing, overcrowded at the time, and yet no harm resulted. Robertson gives most interesting examples of how the fever is spread by intermediaries. In his opinion, the Leith epidemic originated in the docks, and he points out the opportunities for the dissemination of the meningococcus by "intermediary" labourers spitting, and inhaling the dust of dried secretions. At the time when the fever was most prevalent, cold, dry, and dusty weather prevailed, and Robertson is strongly of opinion that the germs can be air borne. Like typhus fever, the disease, in the first instance at least, invaded the houses of the poorer classes, and particularly those of the dirty and dissolute. There was no suggestion of any school epidemic, although 14 different Leith schools were affected.

It may be noted here that Wright, in a paper on the Glasgow outbreak, expressly states that he has not found the disease particularly among the very dirty and uncleanly. The cases, however, did occur chiefly among the poor, and in one-roomed and two-roomed houses. Wright does not think that insanitary conditions generally play an important part in the propagation of the disease. In those families, in which multiple cases did occur, the carelessness in dealing with fomites and fæcal discharges was strikingly manifest. The suggestion is put forward that the diplococcus may be a

constant, or occasional, inhabitant of the bowel in man, and may, in certain circumstances, become pathogenic. Wright notes that Symmers has found the intestine engorged, and the solitary glands enlarged in certain cases, and, as will be seen below, others have made the suggestion that the bowel may play a part in the causation of the fever.

The precautions taken at Leith to check the spread of infection had, as their main object, the detection and disinfection of the "intermediary." Robertson agrees with Jehle that the mere isolation of the patient, and the disinfection of the house constitute a waste of public funds. Unless the carriers of infection are also dealt with, nothing has been gained by such a procedure. The practice adopted at Leith consisted in the systematic application of a bactericide to the nasal and buccal cavities. A lady sanitary inspector visited the infected houses, and douched the noses and sprayed the throats of every member of the household remaining after the infected person had been removed to hospital. The disinfectant used was chlorine water. This douching was repeated on three occasions at intervals of two days. In addition to this, the lady inspector supplied formamint lozenges, which are a pleasing preparation of formaldehyde, and are taken well by children, being allowed to dissolve slowly in the mouth. Robertson also, in some special instances, quarantined the contacts, if the bad condition of the houses rendered such a course desirable. During this isolation of the contacts, their houses were radically disinfected with the formaldehyde spray; the stairs and the pavement, in the vicinity of the tenements, being also treated in this manner. All bedding and fomites were disinfected with steam, and all foodstuffs in the poorest houses were confiscated and replaced at the public expense. This last step was taken as a precaution against any chance of the infection being communicated by articles of food. Robertson concludes that Leith has escaped the ravages, which have characterised outbreaks at other places similarly situated, and that some confidence can be entertained of successfully coping with the disease. Certainly the lines, on which he has worked, would appear to be the right ones, and the only criticism one can offer is that it is curious that the disease abated in Edinburgh synchronously with its abatement in Leith,

although house disinfection was the only means adopted in the latter city. It will be interesting to compare the incidence of the disease in the two cities in the coming winter, when, judging from the experience of Boston and New York, we may confidently expect a recrudescence of it.

PORTAL OF INFECTION.

Fowler, in an account of cases treated at the Edinburgh Hospital for Sick Children, raises the question of the path by which the organism reaches the central nervous system. Certain pathological observations, made by Stuart Macdonald, led to the belief that the disease may be related to acute abdominal infection. Such a view, of course, in no way contradicts the theory that the germ is, in many instances, first harboured in the nose and throat. It is, however, in opposition to the theory of the penetration of the cribriform plate by the micrococcus, which, on the face of it, would appear to present anatomical difficulties. In favour of Macdonald's view, Fowler points out that, in most cases, the post-mortem appearances show that the cord lesion is of older standing than that of the brain. Secondly, the constant, early, and complete abolition of the abdominal reflex seems to point to early implication of the lower dorsal cord. In a case of pneumococcal meningitis, in which the spinal fluid was clear, there was no abolition of the abdominal reflex. In two other cases, in which the fluid was turbid and swarmed with pneumococci, the reflex was abolished. This suggests that abolition of the reflex points to a spinal lesion. As meningococci can be detected in the spinal fluid from the very onset of cerebro-spinal meningitis, it is probable that, in that disease, the spinal infection is primary. Thirdly, in many cases, the disturbance of cerebral function is very slight, even when pus has been removed from the spinal cord. Fowler states that none of his cases were exclusively breast-fed infants, and the possibility of bowel infection is therefore evident. Against this we have the evidence of Robertson, who found that some breast-fed infants at Leith contracted the fever, though he admits that this does not exclude the possibility of the child being infected through the bowel, as mothers often wet their nipples with their saliva.

Our own experience at the Edinburgh City Hospital is certainly in favour of Macdonald's view. The front part of the base of the brain, which, if the infection reaches it directly from the nose, one would naturally expect to bear the brunt of the attack, has been wonderfully free from inflammation in our 28 post-mortem examinations. The lesions of the cord have, with very few exceptions, been much more severe, and apparently of older standing, than those of the brain. Many cases, moreover, have shown, as Macdonald has pointed out, considerable enlargement of the mesenteric glands. Clinically, we have found early abolition of the abdominal reflex a very frequent symptom in those in whom we have been able to satisfactorily test it. Out of 48 cases, in which the abdominal muscles were not held too firmly by delirious or excitable patients, the reflex was only present in nine instances.

SYMPTOMS AND DIAGNOSIS.

The report of Billings on the recent epidemic in New York gives a large amount of valuable information, not only regarding the sex, age, and conditions of life of the patients, but also the symptoms which they presented. As the report covers 2,180 cases, it is obvious that there is much to be learned from it. As regards *sex* the patients were fairly equally divided, 55 per cent. being males and 45 females. It may be mentioned here that a similar preponderance of the male sex has been noted in Edinburgh, the percentage up to date being 62 males to 38 females. *Age* has, of course, much more influence. Sixty-seven per cent. of the New York cases occurred in children of under 10 years of age, only 1 per cent. over 50 years of age. No less than 15 per cent. were infants of under one year.

In only 6 per cent. of the cases was there any evidence of direct *exposure*. In the majority of instances the patients were in good health just before the onset of the disease. The *onset* was practically always very sudden ; only 5 per cent. of the patients showed an insidious commencement. Robertson noted at Leith the same feature in his patients, and our experience at Edinburgh has led us to regard with great suspicion any case which does not start quite suddenly. It is not unusual for a patient to go to bed quite well and to be found delirious, comatose, or in a convulsion the following morning.

The commonest of the *symptoms* was stiffness of the neck, which Billings found to be present in 85 per cent. of the cases. Closely following it came vomiting, headache, and convulsions. I may mention here that initial vomiting was noted in over 70 per cent. of the Edinburgh cases, while convulsions at the outset were much less common, only 14 children commencing their illness with a fit. Billings does not mention the marked head retraction which is so frequently present. No doubt it is included in his figures under stiffness of the neck. Many patients, who have no obvious retraction, unquestionably suffer from marked neck rigidity. An eruption was present in 30 per cent. of the New York cases, being in 19 per cent. petechial, and in 11 per cent. herpetic. It is probable that, in an average epidemic, these useful aids to diagnosis cannot be expected to occur in any higher proportion than this. Our own figures in Edinburgh tally almost exactly with those of Billings. To continue his list, nasal discharge was only noted in 13 per cent. Kernig's sign, however, was absent in only 15 per cent. of the total cases. In Edinburgh we have so far found it absent or uncertain in nearly 30 per cent. of the patients.

Fowler, in the paper referred to above, points out the frequency with which consciousness is well preserved, notwithstanding the acute inflammation of the meninges. Another feature of his cases was that the patients complained very little of pain. No doubt in children this is often the case, but, in older patients, headache and pain in the back of the neck are often so severe as to form one of the most distressing manifestations of the disease. Hyperæsthesia is a practically constant symptom, and is noted both by Fowler and Robertson. It was present in nearly all my own cases, and its most pronounced feature is undue sensitiveness to cold.

Robb, in a paper read at the British Medical Association meeting this year, has had a very similar experience with regard to the symptomatology of the disease. He emphasises the possibility of very mild cases of the disease being overlooked. Vomiting occurred in over 95 per cent. of his cases, headache was usual, and the temperature varied greatly, and was of little value as regards diagnosis and prognosis. The pulse was slow and full in severe cases; a rapid and small pulse was more common, and of more favourable import.

Rigidity of the neck was constant in all but a few cases; arching of the spine was common in infants, but rare over the age of five years. Squint, always of the internal variety, occurred in 28 per cent. of the cases. Facial paralysis developed in 11 cases, hemiplegia in 4, and aphasia in 3. Purpuric rashes were observed in less than 20 per cent. of the cases. Slight general enlargement of the lymphatic glands was generally present. The above figures refer to a series of 230 cases.

As regards *bacteriological diagnosis*, the discovery of the diplococcus of Weichselbaum in the spinal fluid is of course final. But it is to be remembered that, while for purposes of rough diagnosis the presence of intracellular diplococci is practically sufficient, the exact nature of the organism can only be determined by careful methods of culture. Baginsky, in an article on pseudo-epidemic cerebro-spinal meningitis, gives a description of four cases which were clinically indistinguishable from the typical fever, except that they had a more rapid and more favourable course. This is in itself surely no distinction at all, as all other writers are agreed that the real epidemic fever may occur in very mild forms. The first of Baginsky's cases gave turbid fluid on lumbar puncture, and, on examination, the fluid was found to contain polymorphonuclear leucocytes, some of which contained diplococci. Further bacteriological examination showed that the organism was a staphylococcus, and other cases of a similar type seemed to depend on pneumococci, streptococci, and other micro-organisms. It is particularly interesting to note that the pneumococcus was responsible for one of these mild cases, as it is usually considered that a pneumococcal meningitis is even more fatal than a meningococcal one. Osler, indeed, in a paper already quoted, remarks that the main distinction of cerebro-spinal fever from pneumococcal, staphylococcal, and streptococcal meningitis is that recoveries are not uncommon in the former, and are practically unheard of in the latter.

Sicard and Descamps, in discussing the value of a study of the cerebro-spinal fluid in diagnosis and *prognosis*, point out that a milky appearance of the fluid is quite sufficient to eliminate tubercular meningitis from consideration. Favourable signs are the substitution of healthy polymorphonuclear cells

for the original degenerated ones, the appearance of endothelial cells and lymphocytes, and a diminution in the amount of albumin. Lastly, a gradual return to the normal amount of glucose in the fluid, that is a proportion of 50 to 60 centigrammes to the litre, is of good augury.

Droba and Kuczera, from a macroscopic and microscopic examination of the spinal fluid, divide the cases which they have observed into three groups. In the fulminant cases, the fluid is turbid and contains a large quantity of epithelial cells with only a small number of intracellular micro-organisms. In the acute cases, lasting from two days to two weeks, the main features were the presence of numerous polymorphonuclear cells, few lymphocytes, and large numbers of cocci which were often intracellular. Lastly, the chronic cases gave a very slightly turbid fluid containing few polynuclears, many lymphocytes, and few intracellular organisms. The macroscopic appearance of the spinal fluid gives no indications on the severity and probable course of the fever, nor is anything to be learnt from the number of cocci present. They may be found for two or three months from the onset of the disease.

TREATMENT.

As regards *general treatment*, the results so far have not been encouraging. Robb found no advantage from the use of iodides, bromides, quinine, salicylates, or mercury. There is no drug which in any way can be regarded as a specific for the disease. Treatment has been mainly directed to relieve certain symptoms, notably the headache. For this morphine has perhaps the greatest reputation. Some of the recent writers speak well of it. In very violent cases, it is probably sometimes a necessity, and, given in full doses, it undoubtedly keeps them quiet. My own experience is against its use, as I think the patient is usually the worse for it afterwards. Robb found that the headache was best relieved by phenacetin. I have found this disappointing, as also is caffeine, though occasionally temporary relief is given. Chloral and bromides seem to do well in some cases, but the patients rapidly become tolerant of them, and require frequently repeated doses. Still, I think chloral is probably the most satisfactory drug to use.

Dr. Brownlee, of the Glasgow Fever Hospital, recommended it to me at a time when my experience of morphine had been most unfortunate, and I have used it largely since. Sulphonal will occasionally give a patient a good night's rest and render him quieter during the following day. The best sedative treatment is unquestionably that by hot baths, though it must, of course, be supplemented by the use of drugs. The baths should be very hot, and may be repeated three or four times in the twenty-four hours. This treatment is well spoken of by Osler, Robertson, and many others. It naturally requires a larger staff of nurses than would be otherwise necessary, but the comfort to the patients is so marked that it can hardly be dispensed with.

LUMBAR PUNCTURE AND SPINAL INJECTIONS.

Locally, the main suggestion for treatment would appear to be the relief of pressure by repeated lumbar punctures. The value of this, however, is, I think, extremely limited. Fowler notes that no relation seems to exist between the pressure of the cerebro-spinal fluid and the presence or absence of such symptoms as Kernig's sign or spinal rigidity. He points out that intra-spinal pressure, as shown by the rate of outflow, is not an absolute index of what exists inside the cranium, because, in chronic meningitis, matting at the base of the brain readily blocks the channels between the cranium and the spinal canal, and may even lead to hydrocephalus without there being any rise in the intraspinal tension. I may go further and add that, at one autopsy, no spinal fluid having been obtained during life by lumbar puncture, a large amount of purulent fluid was found in the canal, completely shut off from the lower part of the cord by adherent membranes.

Fowler holds that the therapeutic value of puncture is small, though temporary improvement was noted in some of his cases. On the other hand, Schnirer, in an analysis of the Report of Droba and Kuczera on the epidemic in Galicia in 1905, mentions that Droba used lumbar puncture as a means of treatment with considerable success. He withdrew small amounts of fluid, 5 to 10 c.c., daily or every two or three days, according to the amount of pressure. Each puncture was

followed by a marked amelioration of the symptoms, headache ceased, rigidity was diminished, and consciousness returned. The temperature, however, was uninfluenced. Osler also is in favour of this method of treatment. We may conclude that puncture is harmless, and that occasionally the patient is slightly the better for a procedure which is always useful for diagnostic and prognostic purposes.

It is natural that attempts should have been made to treat the condition locally by the injection of antiseptics. Lysol seems to be the favourite substance for this purpose. Fowler considers that it is useless. He employed it in a one per cent. solution. Robertson also employed it, but does not speak enthusiastically of it. Collargol was also tried by Fowler, but this gave rise to unpleasant symptoms, such as tremor and violent delirium. However, at the autopsy of a patient treated in this manner, traces of the drug, which has a dark brown colour, were found at the base of the brain. So it is reasonable to suppose that a more suitable antiseptic might be effective, and, in any case, would have a chance of reaching the parts affected by the inflammation. Dry cupping at the back of the neck was also employed in the Leith epidemic.

SERUM TREATMENT.

The increased prevalence of cerebro-spinal meningitis has naturally led to many attempts to provide a satisfactory serum treatment. One of the best known serums, hitherto produced, is that of Kolle and Wassermann. These investigators found that there were many difficulties in the way of determining the therapeutic value of their preparation, which was obtained by inoculating horses with both dead and living cultures of the meningococcus, and also by the use of an artificial agressine, prepared by putting a twenty-four hours old culture in distilled water, and shaking it up for four or five days. The serum, however, though it agglutinated most strains of true meningococci satisfactorily, also occasionally agglutinated pseudo-meningococci as well. Another difficulty was the extraordinary difference in the resistance of animals, of the same species and weight, to the meningococcus cultures employed. Even the animals which succumbed to the infection showed marked differences, when examined after death.

In some, the meningococci were living and free, in others nearly all the germs were taken up by phagocytes, in others, again, no germs could be discovered at all. An attempt to obtain a culture of constant virulence, by successive inoculations from animal to animal, also failed. These difficulties in experiments on animals compelled Kolle and Wassermann to prove the presence of anti-bodies in their serum by hæmolytic experiments *in vitro*. They satisfied themselves that these anti-bodies in reality were present, and that they were most abundant in serum prepared by intravenous injection of living cultures. They recommend the subcutaneous injection of their serum in man in doses of 10 c.c., and are satisfied that it is perfectly safe. It may be added that this serum is on the market, and has been used in various places during the present epidemic.

Jochmann, in his attempt to prepare a serum, found the same difficulty in regard to the effect of the meningococcus on animals. He, however, succeeded, by repeated tests, in securing a number of strains which, in one loopful doses, killed mice regularly in from 12 to 14 hours. He used mice to test the protective qualities of his serum which he obtained by the inoculation of horses. The horses were injected at weekly intervals, at first with dead cultures in gradually increasing doses, and afterwards with living cultures in the same way. The animals reacted well. The serum thus obtained is, according to Jochmann, of the greatest use in distinguishing the meningococcus from other germs of a similar appearance. As has been seen above, however, other writers have not much confidence in the agglutination test in this connection.

Jochmann states that his serum has been used in 40 cases of cerebro-spinal meningitis. Some of these, however, had very small doses, such as 10 cc. given subcutaneously, and others were treated too late, having already hydrocephalus. A series of 17 cases, treated by Krömer at Ratibor, afforded a good test of its value. They were for the most part children, and not more than seven days ill when the treatment was commenced. The method used was to give an injection of 20 or 30 cc. subcutaneously on the day the patient first came under treatment, and to repeat this on the two succeeding days. In 11 of the cases, however, the second injection was given

directly into the spinal canal. Jochmann had convinced himself previously, by experiments on the cadaver with injections of methylene blue, that an intralumbar injection could be trusted to penetrate to the base of the brain as far forward as the olfactory nerves. After removing 30 to 50 cc. of the spinal fluid by lumbar puncture, it was replaced by 20 cc. of the serum through the same cannula. If necessary, as, for instance, in the presence of increased fever, these intralumbar injections were once or twice repeated. Of the 17 patients only five died, three of whom were children who had already hydrocephalus when they came under treatment. Nine of the patients, six of them after lumbar injection, showed a marked improvement, with a rapid fall of temperature and continued freedom from fever. Twice an increase of temperature preceded the ultimate fall. Three cases showed only a transitory remission of their fever, and, at the time of publication, were still under treatment. Cessation of headache and lessening of rigidity were also noticed. Jochmann adds that the relief of the intralumbar pressure by the oft-repeated tappings was also of importance in obtaining these results. He considers that the serum has the best chance of success if it is injected into the spine. No ill effects followed either the subcutaneous or intralumbar injections. From its effect on animals, the serum might be reasonably supposed to be of value as a prophylactic in man.

Schöne has treated 30 cases with this serum of Jochmann's. He divides his patients into five groups, according to the method in which the serum was administered and the results obtained. Five patients had subcutaneous injections of small doses at long intervals, but, so far as could be observed, the patients were not influenced by the treatment. A second group, also of five patients, who came under treatment from the fourth to the sixth day of the fever, received both subcutaneous and intralumbar injections. A third group of four patients were treated, from the commencement of the disease, with subcutaneous injections, and did well. In another group, also of four patients, this treatment completely failed. The last group of eight patients received intralumbar injections only from the start of the fever. Sometimes the temperature fell after the first injection, but often several injections were

required, the largest total amount given being as much as 180 cc. Of 30 patients treated, 21 were improved, 5 had not a fair chance of improvement, and the remaining 4 resisted the treatment. Of the patients cured, 13 required only one injection. The total death-rate was 28 per cent., as against 53 per cent. in the case of patients who were not treated with serum. Transient albuminuria, urticarial rashes, and joint pains were noted occasionally as sequelæ.

Ruppell has also succeeded in preparing a serum. He obtained cultures from typical cases of the disease, and eliminated all strains which were Gram positive. Considering that, for the adequate graduation of dosage, a fluid medium is absolutely necessary, he set himself to discover a suitable one, and apparently succeeded in doing so, though he does not state what it is. On this medium, the meningococcus grew for eight months without any modification of its characteristics. It was also striking that the culture retained a remarkable virulence for animals. Ruppell points out that Kolle and Wassermann, and others, have never been able to produce a disease in animals resembling cerebro-spinal meningitis. They never succeeded in cultivating the coccus from the blood of their animals, which succumbed, and were forced to assume that death was due to toxæmia. At first, Ruppell had the same difficulties. All he could do was to kill mice and guinea-pigs with relatively large doses of culture injected into the peritoneal cavity. But, after five months' experimentation, a particular strain took on a high pathogenicity. Rabbits showed paralytic symptoms in the extremities, then suffered from rapid and laboured breathing, and lastly had convulsions accompanied by rhythmical movements of the head, symptoms which preceded death. Meningococci were recovered in pure culture from the pleural fluid, the heart's blood, and from the cerebro-spinal fluid. These results made Ruppell doubt whether this particular strain of meningococci was in reality identical with the organism of Weichselbaum. On comparison, however, he could discover no differences. Ultimately he succeeded in immunising animals against his virulent strain, by inoculations with non-virulent strains of undoubted meningococci injected subcutaneously. He also succeeded in raising the virulence of another strain of cocci. He considers that this capacity of

non-virulent meningococci to take on virulence can be made use of to identify the real organism, as neither Gram positive diplococci, nor other strains, which resemble meningococci, can be rendered more virulent.

Ruppell has for some time been engaged in injecting horses with virulent material, and has succeeded in producing a serum the protective and curative qualities of which are clearly demonstrable. This serum in a dose of $\frac{1}{250}$ cc. protects white mice against 100 times the minimum lethal dose. Jochmann's serum, from Ruppell's experiments, has also a marked protective power, a dose of 0·1 cc. protecting mice against from 10 to 100 times the fatal dose of culture. Ruppell considers that the agglutination test with his serum is of value in distinguishing real meningococci from other forms of diplococci. But it is of no use in testing the value of a bacterial serum in protective and curative substances.

Flexner, who has been also working at this subject of immunity to the meningococcus, has done most of his work on monkeys, as in this animal the conditions more nearly resemble man. The small amount of spinal fluid, however, which is found in the normal monkey, and the readiness which the animal shows to develop pressure symptoms, after spinal injections, made his experiments very difficult. Nevertheless, he was able, by injecting quantities of meningococcus culture, to cause very marked lesions in the cord and brain of the animals, and to satisfy himself that he had succeeded in producing the disease. His experiments established that the diplococci, when introduced in a low level of the spinal canal, distribute themselves in a few hours, and excite an acute inflammation, the exudate of which accumulates chiefly in the lower spinal meninges and the meninges of the base of the brain. The distribution of the exudate led him to doubt the validity of the reasoning, which would ascribe this localisation of the inflammation in man to the entrance into the meninges of an infecting agent directly through the nasal mucous membrane.

Flexner's attempts to treat infected guinea-pigs with immune serums were not particularly successful. The rapid course of the disease in these small animals no doubt accounts to some extent for the results obtained. He, however, had better fortune with a serum prepared from monkeys

which were injected with the exudate of the peritoneal cavity of infected guinea-pigs. This anti-serum was found capable of protecting monkeys from infection, and even of stopping the progress of the disease after it had once started. It is worthy of note that normal monkey serum, used in control experiments on infected monkeys, failed to influence the course of the infection. Flexner does not consider that the experimental results with the anti-serums were sufficiently striking and constant to make this mode of treatment of human cases of cerebro-spinal meningitis of very hopeful augury. But he thinks that more active anti-serums may be produced, and that they may prove of value by direct spinal inoculation, possibly even by intravenous or subcutaneous injection. It is only exceptional cases in man, which show such profound intoxication, and such a rapid course as are regularly seen in the inoculative disease in animals. Provided, then, the treatment is commenced sufficiently early, and before too severe structural changes have taken place in the nervous system, there is a possibility it might have a certain amount of success.

We may add that, although it is not mentioned in the above contribution, Flexner has prepared a serum which has given encouraging results in the human subject.

Some of the serums, mentioned above, have been tried in various places in this country during the present epidemic. Robb states that three were used in Belfast without any satisfactory results, and I understand that other observers have met with no better fortune. I have used all of them at the Edinburgh City Hospital, and also a serum prepared by Messrs. Burroughs and Wellcome. It is too early yet, however, to give any very definite opinion on the merits of this form of treatment. I am inclined to think that, when given directly into the spinal canal, a better result may be occasionally obtained than could be reasonably expected, if the case had been left without serum.

Phagocytic activity is usually increased by its employment which, I suppose, we must regard as a point in its favour. On the other hand, all of these serums fail to save fulminant cases. It is, however, just this class of case which is most analogous to the artificial disease produced in animals.

VACCINES.

A very complete and interesting account of the case of a child, treated by a vaccine prepared from its own micro-organisms at the Liverpool City Hospital, is given by Rundle and Mottram. The patient came under treatment late, having been a fortnight ill before admission to hospital, and was already much wasted. From the day of admission till the vaccine was first used (some ten days later), its condition got progressively worse. It had marked opisthotonos, and suffered from persistent vomiting. The spinal fluid contained the diplococcus intracellularis, but repeated lumbar punctures had no favourable influence in the course of the disease. After the first vaccination, 48 hours elapsed before any improvement was observed, but, after that period, the rigidity became less, the spine could be straightened and lateral movements of the head were made voluntarily. After a second dose of vaccine, vomiting entirely ceased, and progressive improvement was noted after each of three subsequent vaccinations. Apyrexia occurred after each injection, and there were no definite relapses, the rises of temperature which occurred not being accompanied by any exacerbation of symptoms.

The vaccine was prepared by inoculating a 24-hours old culture into sterile normal saline solution, and placing it in a water bath at 60° C. for half an hour. Its sterility was tested by inoculating nasgar tubes from it. The number of organisms was estimated. For the first four doses a fresh vaccine was prepared each time. The first dose was 200,000 micro-organisms. The opsonic index rose from 0·7 to 1·5 on the following day. It afterwards fell to 0·9, and remained about this level for four days. A second injection was then given, and was again followed by a rise in the index. Subsequent inoculations produced similar results. It seemed reasonable to suppose, then, that the rise was caused by the vaccine. Experiments with the agglutination reaction were less convincing. It was found to occur also with normal serum, and serum from a patient suffering from another disease (scarlatina).

Radmann has used successfully the patient's own cerebro-spinal fluid as a vaccine in two cases. His argument is that subcutaneous injection of the meningococcus into animals

fails to produce the disease, intra-dural injection being required. It would appear then that the subcutaneous tissue is unfavourable to the development of the meningococcus, while it may permit the establishment of a reaction of immunity. As the virulence of cultures is very irregular, he employed the cerebro-spinal fluid of the patient himself. One of his cases was punctured on the tenth day of the disease and 25 cc. of turbid fluid withdrawn. Having ascertained that the fluid contained meningococci, he injected 8 cc. into the skin of the arm. There was no local reaction, and the temperature fell to normal in three days. A fortnight later the patient was convalescent. The second case also recovered. Radmann holds that there is no danger in this procedure, and all that is required is to be careful about asepsis, and to make sure of the diagnosis before injecting the fluid.

This treatment is at least very simple, no special preparation being required, and no time wasted in preparing the vaccine. I have tried it in three severe cases. Though I did not succeed in saving any of them, two appeared improved after the injections, and in all the opsonic index rose considerably. In none was there any inflammation at the seat of injection, which is a remarkable fact when it is considered that the fluid injected was almost purulent.

Miss Taylor has also investigated the opsonic index and agglutination reaction in a series of 8 cases of cerebro-spinal meningitis. The emulsion of meningococci used was made from a culture on blood serum. The chief difficulty experienced was the tendency of the diplococci to degenerate during incubation. But, in cultures of only 7 to 10 hours growth, it was found that this degeneration did not occur. When young cultures were used, the opsonic power of control serums was found to be extremely small, whereas the serum from meningitis cases showed enormously increased opsonic power. It is advisable not to use too thick an emulsion, as otherwise the number of germs in the cells may be so great that there is difficulty in counting them. While observing the index, it was noted that agglutination was a marked feature. This however did not occur in the control serums. For testing agglutination alone, a thick emulsion is to be preferred. Serum from cases of enteric fever and tubercular meningitis failed to

agglutinate the organisms. The dilution used was 1 in 3, which seems somewhat low, but which worked satisfactorily.

A high opsonic index was found present in all the cases examined. In a case in which the index to tubercle was examined along with it, the former showed no variation from its usual course at a time when the meningococcus index was rising. In cases of tubercular meningitis, moreover, the meningococcus index was not raised, though the tubercular index was high. It is probable that a high index is pathognomic of the disease. A normal index, however, does not negative its presence, differences occurring according to the strain of organisms used.

As regards the differentiation of different forms of meningococci by means of the opsonin and agglutination tests, Miss Taylor found three strains of micro-organisms which reacted differently. She thinks it probable that, to obtain the fullest effects from a serum or vaccine treatment, the strain of organism used in its preparation is a matter of great importance. One of the cases examined was treated with a vaccine, and two with Ruppell's serum. The injections were each case followed by an increase in the opsonic index.

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THE ARREST OF HÆMORRHAGE AFTER LABOUR.

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It has always appeared to me a remarkable fact, having in view the extreme gravity of the complication, and the comparative frequency of its occurrence in actual practice, that no writer of a text-book on obstetrics, with the exception of Playfair, has thought the physiological process of the natural arrest of bleeding, during and after separation of the placenta, of sufficient importance to merit a discussion in detail. And yet, unless we have before our minds a satisfactory working theory of the steps of the process, by which this is effected by the normal parturient uterus, how is it possible to arrive at correct methods, based on surgical principles, which the practitioner shall apply, when the natural powers of the woman have failed? Any unbiassed reader of the contributions on post-partum hæmorrhage, from the pens of present day masters of Obstetrics, which have been appearing in the numbers of The Practitioner since August 1906, will at least agree with me, that nothing remotely approaching unanimity of opinion exists in the minds of these exponents of the obstetric art on the important question of the physiological arrest of post-partum hæmorrhage.

The divergence of opinion revealed by these articles is significant; and, although many of the strictures of Mr. Stanmore Bishop upon our teachers of obstetrics are amusing, he has done good service in focussing attention on the subject.

Such explanations as are offered in our text-books, concerning the means by which the parturient uterus controls hæmorrhage, are, to my thinking, impossible of acceptance; and they are open to the still further objection of never informing us whether, in post-partum bleeding, it is on the arterial, or on the venous side that most danger exists: in a word, whether, after separation of the placenta, it is arteri

or venous blood which is lost during a flooding. I consider this point the crucial one of the whole question; and, until it is definitely settled, I do not see how the treatment of post-partum hæmorrhage is to be placed on a rational and sound basis. Every surgeon, on being called to a case of hæmorrhage, would at once satisfy himself as to the source of the bleeding, whether arterial or venous, and shape his treatment accordingly. Not so the obstetrician. He is content to ignore this cardinal point in his fight with post-partum hæmorrhage; and too often his best efforts consequently end in disaster.

Mr. Stanmore Bishop, by his thorough-going advocacy of the method of aortic compression for the arrest of post-partum bleeding, is evidently an ardent believer in the idea that the safety of the patient is best consulted by trying to control the *arterial* supply of the placental area, lest she bleed to death, either from ruptured arterioles, or through the small arteries, which empty into the maternal sinuses, laid open by the separation of the placenta. Dr. Hastings Tweedy, apparently, also tacitly accepts this doctrine, and mentions the method of aortic compression with approval as a means of temporarily controlling hæmorrhage. He also quotes Jellett and Lusk as recommending the plan.

It is, however, in the critical article of Dr. Herman, that we come upon the teaching at present in vogue in the medical schools. It is the one on which I was nourished; and I quarrel with it, because it is vague, contents itself with merely talking about "the vessels," and thus evades the very important question, on which side of the circulation, arterial or venous, most danger to the patient lurks in case of failure of the natural powers. I will quote from Dr. Herman's article to make this plain. "Anyone who puts his hand on the abdomen of a woman, who has just been naturally delivered, will feel the uterus. It is firm, its shape is definite; its inner wall is applied to the placenta; *its muscular fibres are grasping and constricting the vessels;* and in this condition it remains. This is retraction. Every few minutes the uterus becomes smaller and harder; *it grips the vessels more tightly*, and it squeezes the placenta; and if the placenta is loose, it squeezes it out. This is contraction. The patient is not safe,

in the third stage of labour, until this condition of retraction with intermittent contraction has come to stay." I have a further objection to urge against this passage, in that it attributes the hæmostatic power of the uterus to the "muscular fibres grasping and constricting the vessels"; whereas, as a matter of fact, the bleeding points are the open uterine sinuses and ruptured arterioles, which are situated in the superficial layer of the decidua serotina, quite internal to the muscular coat, and incapable of being compressed by it. I shall further on, in the course of this article, return to this point, and shall try to show that, if the idea put forward by Dr. Herman is a faithful representation of the actual means adopted by nature for arresting hæmorrhage in the third stage of labour, then retraction with intermittent contraction, so far from being safe, ought to be a process fraught with the deadliest peril to the patient.

From that school of thought, which believes that the best method of treating post-partum hæmorrhage lies in means directed to controlling the arterial supply of the uterus, I dissent. I am of opinion that the bulk of the blood, lost in post-partum hæmorrhage, flows from the maternal sinuses through the uterine veins *by a backwash from the inferior vena cava;* while that lost through ruptured arterioles is, in comparison with the former, a small and almost negligible quantity.

Unfortunately, the question of the arrest of hæmorrhage after labour has not, so far as I am aware, been made the subject of an experimental investigation in the lower animals. Until this has been done, the only method open to us to arrive at a solution of the problem as to how nature controls hæmorrhage, after separation of the placenta, must be a deductive one, based on (1) the histology of the normal and the pregnant uterus respectively, having regard especially to the vascular changes which occur in passing from one state to the other; (2) the nature of the hæmorrhage which may occur after separation of the placenta, whether arterial or venous; (3) an inquiry whether the uterus is supplied with any special means, not found in other organs, for arresting hæmorrhage. It is not my intention, and it would be quite beside the object of this paper to do so, to enter into any

detailed description of the histology of the uterus. It will only be necessary for me to give, in broad outline, the structures composing the wall of the uterus, and to very briefly indicate the modifications which occur in these tissues in the pregnant state, laying special stress on points which I consider of importance in the anatomy of the organ. This much I must do for the purposes of my argument, and for making clear the ideas which I am about to advance.

(1) The wall of the virgin uterus consists of a mucous membrane, muscular coat, and an outer covering of peritoneum. The mucous membrane is covered with a ciliated columnar epithelium, and is provided with a great number of tubular glands. It contains a fibrous and elastic tissue matrix, and is freely supplied with blood vessels. According to some observers, bundles of muscular fibres are said to penetrate the mucous membrane from the muscular coat, but this is denied by Klein. The important point about this mucous membrane is, *that it is fixed directly to the muscular coat of the uterus without the intervention of submucous areolar tissue* found in every other hollow viscus in the body. The result of this anatomical peculiarity is, *that the mucous membrane must accurately follow, and adapt itself, not only to contractions of the muscular layer, but to that continuous alteration in size of the uterus brought about by the retracting muscular fibres during the progress of labour and expulsion of the fœtus.* The significance of this important fact will appear later.

The muscular coat forms the chief part of the wall of the uterus, and its fibres are entirely of the unstriped variety. Their arrangement varies in different parts of the uterus, but in the fundus they are arranged in three layers (Heule):— (*a*) An outer thin stratum, arranged longitudinally. (*b*) A middle coat, in which the prevalent direction of the bundles is circular, but having a good number of longitudinal bundles between them. Eden calls this layer reticulated, and in it describes some of the vessels as being surrounded by muscular fibres arranged in figure of eight fashion. (*c*) An inner stratum of oblique and transverse fibres. According to Eden this is a circular layer.

The peritoneal coat is of no importance in this connection, and need not be referred to further.

The blood supply of the uterus is derived from the uterine and ovarian arteries, the former supplying the cervix, body, and part of the fundus, and the latter the fundus only. Both arteries are tortuous, the uterine distinctly so. The latter is straight at birth, the tortuosity appearing later, and becoming a very distinctive feature as sexual and bodily maturity are reached. The uterine artery enters the base of the broad ligament, runs downwards and inwards to the cervix, and then turns upwards along the side of the uterus towards the fundus. In its course, it gives off transverse branches, also tortuous, both on the anterior and posterior surfaces of the uterus, which lie in a special connective tissue layer beneath the external longitudinal muscular fibres. From these branches, twigs are given off which pass almost vertically inwards again, with a spiral twist, and end in a capillary plexus in the mucous membrane, whence they are drained by thin-walled, valveless veins. These veins pass out into the broad ligament, and thence, mainly by the ovarian veins, to the inferior vena cava and left renal vein. Only a small part of the blood supplied to the uterus finds its way back by the uterine veins.

The circulatory arrangements of the uterus appear to me to possess several striking peculiarities, which, I think, are present in the organ to enable it to adapt itself to the requirements of the placental circulation. These are :—

(*a*) That the uterine artery applies itself to the lower extremity of the uterus, and runs from below upwards, so that the blood has to be driven against gravity. So long as the uterus is unimpregnated, and is only $2\frac{1}{2}$ inches long, the resistance to be overcome is not great ; but when the uterus becomes pregnant, and rises up to nearly the level of the ensiform cartilage at the end of gestation, the resistance to the propulsion of the blood must be progressively increased as pregnancy advances. As there is no cardiac hypertrophy sufficient to overcome this resistance, slowing of the blood, as it reaches the placental site, must result.

(*b*) Owing to the tortuosity of the uterine and ovarian arteries and branches, both the distance to be traversed by, and the resistance to the circulation of, the blood, are increased, resulting in a reduction of its velocity and pressure.

(*c*) The transverse arrangement of the branches of the uterine artery from the parent stem, is probably a further arrangement for reducing the velocity of the blood current in the pregnant uterus.

(*d*) None of the sinuses, intra-uterine veins, or main venous trunks, which convey the blood back to the inferior cava from the uterus, are supplied with valves.

(*e*) With the exception of the figure of eight fibres, described by Eden, around some of the arterioles in the middle layer of the muscular coat, no writer that I have read, either anatomical or obstetric, describes the muscular fibres as having any special arrangement around intra-uterine arteries and veins ; a somewhat important omission, in view of the current doctrines regarding the arrest of post-partum hæmorrhage.

The changes, which take place in the uterus on impregnation, affect the muscular layer and the mucous membrane, the utero-placental circulation becoming established in the latter. In the muscular layer, the existing fibres hypertrophy, and new muscle is added, chiefly in the deeper layers of fibres.

In the mucous membrane, changes are brought about mainly by the growth of the syncytium, or covering layer of the chorionic villi, which, as it grows into the uterine wall, dissolves epithelium, superficial portions of glands, and walls of capillaries, forming spaces, bounded partly by decidual tissue and partly by syncytium, which become filled with maternal blood set free by the erosion of vessels. These spaces constitute the beginnings of the maternal sinuses, and, being formed by the destruction of vascular walls, are extra-vascular and not developed from dilated capillaries. As the placenta grows, the blood spaces expand, and communicate with each other more and more freely. The placental villi hang in the blood of these maternal sinuses, through which a languid circulation goes on. Arteries and veins open directly into these sinuses. The former have a spiral course through both the muscular layer and decidua serotina up to their debouchement in the floor of the sinuses. The veins are destitute of valves, but are bent acutely upon themselves immediately after leaving the sinuses, forming what has been described as a "fulciform valve." Some arteries pass across from the maternal surface, in the decidual processes, to the placenta, but do not com-

municate with the fœtal circulation. They are torn across during separation of the placenta.

Now, the important point to be borne in mind is, that these huge maternal sinuses are developed, and situated in the superficial layer of the uterine mucous membrane, quite internal to the muscular layer. The large veins which drain these sinuses, and return the blood to the inferior vena cava, of course, have to pass through muscular fibres in their outward passage to join the ovarian plexus. But when the fœtal villi are withdrawn from the uterine wall, during separation of the placenta, it is not the veins which are laid open, but the maternal sinuses, the gaping mouths of which are not snugly enclosed amongst specially arranged muscular fibres, by which they could be immediately grasped and sealed, but lie exposed on *the surface of the lining membrane* of the uterus, beyond the reach of any direct compressing force from muscular fibres.

(2) We come now to the consideration of the second point, viz., whether in post-partum bleeding, the loss of blood occurs mainly on the arterial, or venous side of the circulation; whether, in a case of flooding, blood spurts either from arteries torn across in separation of the placenta, or from the mouths of arteries exposed in the floor of the maternal sinuses into which they debouch; or whether the blood pours from the sinuses by regurgitation through the valveless veins, by which it is conveyed from the uterus to the inferior vena cava.

As regards arteries actually torn across, it is legitimate to conclude that they follow the rule of arteries in other parts of the body, and are sealed by retraction. These present no difficulty, and may be dismissed from further consideration.

The maternal sinuses may be compared with large closed reservoirs, to which the arteries supply blood, and from which the veins carry it up again to the heart. It is obvious that, if these reservoirs are suddenly opened (as in separation of the placenta), blood may spurt from the afferent vessels, or it may regurgitate from the efferent vessels or veins, if there are no valves to check the backwash. As we can never see the actual bleeding points, in a case of post-partum hæmorrhage, the matter can only be decided by clinical observation, and inference from the character of the bleeding as it is

presented to us in a typical case. We are accustomed to associate certain definite characteristics with arterial bleeding in other parts of the body, and I think that it is only fair that the same tests should be applicable to the uterus in helping us to form an opinion. The blood lost from severed arteries is always of a bright scarlet hue, and comes in jets, which rise and fall with the heart's beat. The volume of blood, and the force with which it rushes from the vulva, are but too amply sufficient to demonstrate the typical characters of arterial bleeding, did they exist in post-partum hæmorrhage. The blood in post-partum hæmorrhage, on the contrary, is invariably of a dark brown or venous colour; it never pulsates; and it always comes away either in a steady flow, or, in bad cases, in one enormous and appalling torrent. It might be objected by some that it is hardly fair to postulate that the characteristics of arterial bleeding should be visible in post-partum flooding, seeing that the hæmorrhage is taking place into the cavity of the uterus; so that, by the time the blood makes its appearance at the vulva, the usual signs of this type of bleeding would be lost. This objection is not valid, inasmuch as, after the birth of the child, the cavity of the uterus is lost; the cervix being dilated to the diameter of the vagina, and forming one continuous canal with it. I have now attended over a thousand confinements, and, except where bleeding is caused by tears either of perineum or cervix, I have never seen arterial hæmorrhage post-partum. Genuine post-partum bleeding from the placental site is invariably venous, and never arterial.

(3) To bleed periodically is one function of the uterus; to nourish the fœtus for nine months, and expel it at term, always with loss of blood, is a second duty of the organ. To suppose that the muscular force, which can expel a full term fœtus, weighing from 7 to 9 lbs., is also equal to the much smaller task of compressing the torn vessels of the uterus, would appear, on the face of it, to be a very modest and just hypothesis. Indeed, it looks so reasonable and evident a supposition, that, up to the present, it has held the field unchallenged. No writer has had the courage to protest against it, though a few, among them the late Dr. Playfair, appear to have had misgivings. Dr. Playfair noted certain vagaries of the organ after

labour, notwithstanding which no hæmorrhage occurred, and this he was completely at a loss to explain, his faith in the hæmostatic power of the muscular fibres of the uterus being still unshaken. The muscular fibres of the uterus having acquired the reputation of being endowed with hæmostatic functions, their supposed powers in this direction have been accepted by generations of writers without cavil. I question whether any organ in the body has failed so often to act up to its reputation, and yet been able to retain the confidence of its patrons, by whom every excuse is made for shortcomings, and every failure either brushed aside, or explained away.

The unimpregnated uterus loses blood at every menstrual period, yet it is amongst our commonest experiences for this loss to be excessive, and the muscular fibres to be quite unable to exercise the smallest control over it. What the pregnant uterus is said to be able to do by its muscular fibres, the unimpregnated ought also to be able to perform; but its inability to do so is notorious. If the uterine muscular fibres are able to arrest hæmorrhage by compression of arterioles, it is somewhat disquieting to find that such things as menorrhagia, without pathological changes in the uterine wall, climacteric hæmorrhages, and hæmorrhages secondary to diseases of the appendages and pelvic connective tissue, can occur unchecked by the uterus. Not infrequently, menorrhagia is associated, in the same patent, with dysmenorrhœa, a condition which, at all events in some cases, is due to expulsion of clots and shreds by uterine contractions of a painful nature. In this association, we see an example of uterine muscular fibres exercising their purely expulsive function, but quite incapable, despite these painful contractions, of arresting excessive bleeding from eroded capillaries in the mucous membrane. Surely food for reflection is here.

I have cited these examples of bleeding from the non-pregnant organ, because they illustrate conditions of blood being lost from the uterus, when there is no question of the muscular fibres (the supposed hæmostatic agent) being at fault.

Having an unshaken faith in the hæmostatic powers of the uterine muscle, I suppose ninety-nine per cent. of medical men, if asked what drug they would recommend to check

hæmorrhage from the uterus, under any of the conditions mentioned above, would unhesitatingly advise that ergot should be given the first trial. I venture to say that a very large proportion would have to chronicle failure as the result. Ergot is the most powerful stimulant of the uterine muscle that we know. It ought therefore, according to accepted theories concerning the control of uterine hæmorrhage, to be an infallible remedy in checking bleeding from this organ under a great variety of conditions, certainly in all cases cited above.

I note, however, in a recent paper by Dr. Cuthbert Lockyer, that the position of ergot as a hæmostatic is seriously threatened. As ergot acts only on the muscular fibres, it is considered advisable to reserve it for post-partum use only; while styptol and hydrastis, which act as vaso-constrictors, and the former as a uterine sedative as well, are recommended for arresting hæmorrhage from the non-pregnant organ. It is expressly stated, in this paper, that styptol produces no contraction of uterine muscle, but is of value solely for its constricting action on the uterine blood vessels. This is admirable therapeutics: as it brings the treatment of uterine hæmorrhage into line with that of hæmorrhage from other organs, by the administration of vaso-constrictors. The throwing overboard of ergot in the treatment of hæmorrhage from the non-pregnant uterus, however, brings us face to face with this serious anomaly, that whereas, both in the unimpregnated and in the pregnant condition, bleeding may occur from the mucous membrane, in the former, its muscular fibres are not of supreme use in controlling hæmorrhage, while, in the latter state, they are all-powerful in effecting this desirable end; although, be it remembered, the arrangement of the muscular fibres, and their relation to the blood vessels, are the same in both conditions. It is significant as indicating the trend of opinion regarding the supposed hæmostatic powers of the muscular coat. Had contraction of uterine muscular fibres meant hæmostasis, ergot could never have had a rival, still less would it have gone out of favour.

We have still left the consideration of the rôle of the muscular fibres in the arrest of bleeding from the pregnant uterus. And first, I would direct attention to the course of

events in an early abortion. It is a notorious fact that the amount of blood, which may be lost in casting off a four to six weeks ovum, is often very greatly in excess of the quantity, which comes away with the detachment of a full term placenta. In an early case of this kind, although there is well-marked hypertrophy of the muscular fibres of the uterus, and, as yet, no maternal sinuses are formed, the bleeding may amount to a severe flooding. The uterus contracts strongly enough to make the patient aware she is having pains, but, for some reason or another, these pains do not seem able to compress bleeding vessels. The entire ovum, at this stage, is little more than a membranous sac; and, if the contents have escaped, as is usually the case, nothing more is left than a mere bag, certainly nothing to interfere with the action of muscular fibres compressing the vessels in the wall of the uterus. Why this excessive loss of blood, then? The reason, in my opinion, is that, owing to the small size of the organ, retraction cannot come into play to any marked extent, and therefore the muscular fibres are powerless to exercise that compressing effect on the mucous membrane, by which alone they can arrest bleeding from the latter. Hæmorrhage, therefore, only ceases when every shred of the ovum is cast off, the cavity of the uterus obliterated, and the bleeding points on the surface of the decidua compressed by apposition of the uterine walls. The effect of retraction of muscular fibres on the mucous membrane will be fully explained shortly.

With the formation of the placenta, the question becomes one, not of the arrest of capillary oozing from the mucous membrane, but of controlling the hæmorrhage from the large maternal sinuses in the decidua serotina. As I have said above, bleeding from these sinuses may occur either from the arteries, which empty into them, or by regurgitation from the veins which drain them, or from both together. The problem, therefore, is, how these formidable sinuses are closed, after they are torn open by the separation of the placental villi, and the woman saved from speedy destruction. The theory which holds the field, and which has received the sanction of practically all writers on midwifery, is that the torn vessels are sealed by contraction of the muscular fibres. In the early part of this article, I quoted the views of Dr. Herman. Here

is what Dr. Eden says: "It is obvious that exhaustion of the uterus, when the placenta has been separated, will allow of hæmorrhage of the most profuse kind, *for muscular action is the only effectual means of closing the mouths of the torn sinuses.*" And again, "in normal labour, the separation and expulsion of the placenta are neither accompanied nor followed by serious bleeding, because the mouths of the torn maternal vessels are immediately closed by continuous retraction of the uterine muscle, *especially of the reticulated layer, aided to some extent by thrombosis.*

"Retraction is by far the more important of the two; for thrombosis alone must be powerless *to prevent hæmorrhage from large arteries*, until such time has been allowed for the consolidation of the thrombi."

Dr. Galabin also endorses this view, when he writes:— "*Thus both arteries and veins are closed after separation of the placenta by firm contraction and retraction of the uterine muscle.*"

I might quote from the works of other English writers, but as they all agree in the adoption of this view, nothing would be gained by doing so. To judge, therefore, from the writings of these authorities, there would appear to be no difference between arteries, veins, and sinuses. They may all bleed in post-partum hæmorrhage, and they are all sealed by muscular contraction and retraction; and Dr. Eden attributes the chief power in arresting hæmorrhage to the reticulated or middle layer of the muscular coat, aided by thrombosis; although, be it remembered, all the bleeding points are situated on the surface of the mucous membrane.

There would appear to be a consensus of opinion amongst obstetric writers, to judge from the views quoted above, that hæmorrhage from arteries, even of considerable magnitude, habitually occurs during separation of the placenta, which can only be arrested by firm contraction and retraction, aided by thrombosis. I presume what is true of the whole placenta holds good for a part also. Under two conditions, the placenta may get partially detached at the very outset of labour, when contractions are comparatively feeble, and retraction is non-existent. We call the one condition "accidental hæmorrhage" when the placenta is normally implanted; and

the other "unavoidable" when the placenta is prævia. We may fairly assume, if current ideas are true, that, in both these conditions, arteries of fairly large size are laid open. Yet, how do we proceed to deal with these complications? In the first, we rupture the membranes, and drain the amniotic sac, in order to bring the placental site upon the fœtus, and thus exert pressure on the bleeding points, which, in a great many cases is sufficient both to arrest the hæmorrhage, and yet not interfere with the utero-placental circulation; and in the second, we dilate the cervix, deliberately separate more of the placenta, rupture the membranes, bring down a leg, and leave the case to nature, confident that the pressure of the fœtal buttock is equal to the task of arresting hæmorrhage; even though we know that, in the intervals of pains, the presenting part is exercising a very small amount of pressure, if any, on the bleeding area! I ask, does anybody seriously believe that it is possible to check grave hæmorrhage from good sized arteries by such means? Does not the success of the treatment, in the absence of contraction and retraction, and, considering the very moderate amount of pressure, which we are able to bring to bear upon the maternal sinuses, strongly suggest that we must be dealing with *venous* and not arterial hæmorrhage?

Before expressing an opinion as to how contraction and retraction of muscular fibres arrest uterine post-partum hæmorrhage, I should like to say a few words upon the behaviour of the uterus, after the birth of the child. A reference to Dr. Herman's statement in the early part of this article (and this is the usual teaching) tells us that "it is firm, its shape is definite, its inner wall is applied to the placenta, its muscular fibres are grasping and constricting the vessels, and in this condition it remains. Every few minutes, the uterus becomes smaller and harder, etc." I am sorry to say that this is not my experience of the behaviour of the uterus. In my experience, the uterus follows the retreating fœtus down, and when it has expelled it, closes down on the placenta, but not with any degree of firmness. As a rule, its shape is definite; but I have frequently noted that the walls may become quite limp, and the outline of the organ rather ill-defined, without any hæmorrhage occurring.

This state of affairs continues for from seven to ten minutes after the birth of the child, during which time there is an absolute cessation of all pains. They then return at intervals of three or four minutes. When the pains have passed off, the uterus again relaxes. As a result of these pains, a further retraction of the uterus occurs, due to the detachment and expulsion of the placenta into the vagina; and the organ shrinks in size, and becomes like the cricket ball, which, we are all told not to be happy, till we have secured for the patient. But, alas! even when secured, the cricket ball does not maintain its firmness and hardness. Only while the uterus contracts does the organ feel hard. In the intervals it becomes somewhat laxer; but, in spite of the muscular fibres relaxing their hold, the patient does not bleed. What I particularly wish to insist on is, that the condition of the uterus, after the expulsion of the placenta, is not one of tonic retraction, but of retraction with intermittent contraction, followed often by considerable relaxation; and that, notwithstanding the latter, no hæmorrhage occurs.

I am glad to say that the experience of Dr. Playfair supports these statements of mine up to the hilt. He says:—"On the contrary, it is not uncommon to meet with cases, in which the *uterus is large and apparently quite flaccid, and in which there is no loss of blood.* Alternate relaxation and contraction of the uterus, after delivery, are also of constant occurrence, *and yet hæmorrhage during the relaxation does not take place.*"

While all writers on obstetrics agree in attributing a hæmostatic action to the uterine muscular fibres, Dr. Eden's views are, for my present purpose, particularly valuable, since he locates the principal compression of vessels as taking place in the middle layer of the muscular coat, and supposes the arrest of bleeding to be assisted by the formation of thrombi. To arrest hæmorrhage, at this point in the uterine wall, is practically to apply pressure in the continuity of the blood-vessels; and, to be effective, it must be complete, and the lumen of all arteries and veins must be obliterated. Thrombosis would, therefore, occur in all arteries and veins in the uterine wall from the middle of the muscular coat to the mucous membrane inclusive. As contraction and retraction

involve the whole uterus, and not the placental area only, the blood-supply of the whole of this portion of the uterine wall would be cut off. The inevitable result would be sloughing. There is no escape from this position.

Also—looking to the fact that, for some time after the expulsion of the placenta, the uterus continues to contract and relax—as these thrombi must extend a considerable distance into the uterine wall, they would, owing to such action, tend to get aspirated into the general circulation, and gravely imperil the patient's life from embolism. Parturition would be a serious menace to every woman's life, if she really had to face such risks with the birth of every baby.

What, then, are the factors which tend to the arrest of hæmorrhage after separation of the placenta? I believe them to be the following:—

(i) Greater coagulability of the blood.

(ii) Sealing by retraction, as in other parts of the body, of those arteries, which, passing across from uterine wall to placenta, are torn across during separation of the latter.

(iii) The tortuosity of the uterine arteries and all their branches.

As the uterus shortens in every diameter with the descent of the fœtus, the coils of these arteries and branches must be gradually pressed more and more closely together, and finally shut firmly down with the escape of the child. By this means, the resistance to the flow of blood through them must be gradually increased, as the uterus follows down the retreating child, until, probably, at the close of the second stage, the quantity of blood, reaching the sinuses, becomes reduced to a minimum. Owing to the tortuosity of all its arteries and their branches, the uterus, in fact, possesses the power of automatically shutting off the blood supply, during the progress of the child into the world, by its retraction. The blood is therefore free to circulate in all parts of the uterine wall, but in very much reduced proportions. So long as the placenta remains attached to the uterine wall, there is no danger in a small stream of arterial blood languidly circulating even in the maternal sinuses, into which the arteries debouch.

(iv) The termination of the uterine arteries in the maternal

sinuses, and the sinuses themselves, are placed in the mucous membrane. I have earlier pointed out, and laid stress on the fact, that *this mucous membrane is fixed directly to the muscular coat.* Now while muscular fibres are able to contract, and retract, and thus permanently shorten in length, the mucous membrane, on the other hand, is quite powerless to do the same; but being dragged along by the retracting muscular fibres to which it is fixed, it becomes thrown into folds or rugæ, as the only way of adapting itself to the shortened muscular coat. It is obvious that, as a result of this folding, the open mouths of the uterine sinuses and terminations of arteries in them would also become folded up and pressed together. The greater and firmer the retraction of muscular fibres, the more securely would the mouths of the sinuses in the mucous membrane be squeezed together and sealed. According to this view, arrest of bleeding is obtained by pressure on the bleeding points, viz., the uterine sinuses, and not by the compression of vessels supplying these sinuses, or draining them somewhere in the muscular coat. Anyone, who has had to strip a placenta, will have felt the rugose condition of the uterine mucous membrane, and noted that it is particularly well marked towards the fundus or placental region. Given the arrangement of the maternal sinuses found in the mucous membrane, were it not for the fixation of the latter directly to the muscular coat, compelling it to follow its retraction, and thus securing firm closure of the open mouths of the sinuses, I am of opinion that no woman could survive the ordeal of parturition. Were the uterine mucous membrane separated from the muscular coat by a loose areolar tissue, as in other hollow organs, death from hæmorrhage would be the penalty of childbirth. According to the explanation of the closure of the sinuses, which I have offered, clotting would only occur at the mouths of the sinuses, where their walls had been damaged; and the thrombi would be internal to the muscular coat, and therefore not liable to be swept into the general circulation during the alternate contraction and relaxation, which occur after separation of the placenta. Furthermore, contractions of the uterus would only fold up the mucous membrane more tightly, and not endanger separation of the clot, but would rather tend

to hold it more securely in position. For those, who maintain that post-partum hæmorrhage is arrested by the compression of arteries and veins alike, somewhere in the muscular coat, with formation of extensive thrombi, the extreme rarity of embolism, during the puerperium, must be a staggering fact, especially if they recollect that, for some time after labour, the uterus, by alternately contracting and relaxing, would seem to be doing its best to encourage such an accident.

The clinical features of a post-partum flooding leave no doubt in my mind that the bleeding is unmistakably venous. The blood from the huge maternal sinuses is carried to the inferior vena cava by large veins which are valveless. Unless the mouths of the sinuses are securely folded together, regurgitation must result. The treatment of mild cases of post-partum hæmorrhage is thoroughly agreed upon, and need not detain us. That of serious post-partum hæmorrhage resolves itself into the treatment of regurgitant venous hæmorrhage; the extreme gravity of which depends on the fact that the blood, which is pouring into the uterus, is regurgitating from the inferior vena cava through valveless veins. Its correct treatment, therefore, must be carried out by one of two methods :—(1) either to apply direct pressure to the bleeding sinuses, after the method advocated by Dr. Herman of introducing one hand closed into the vagina, while, with the other, the fundus of the uterus is pressed down on to it through the abdominal wall; or (2) to elevate the pelvis and compress, not the aorta, but the inferior vena cava, by precisely the same manœuvre, as practised by Mr. Stanmore Bishop. I am of opinion that the method for arresting post-partum hæmorrhage by compression of the aorta, depends for its success, on compressing, not the aorta, but the inferior vena cava, and thus stopping the backwash of blood from the latter.

BOOKS CONSULTED.

Quain's *Anatomy*.
Klein's *Atlas of Histology*.
Eden's *Midwifery*.
Galabin's *Midwifery*.
Jellett's *Manual of Midwifery*.
Lusk's *Midwifery*.
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Folia Therapeutica, July 1907.
The Practitioner, August 1906; February 1907; March 1907; April 1907.

ORTHOPÆDIC SURGERY.

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SCOLIOSIS.

Drs. Michael Hoke and C. R. Andrews discuss in the *New York Medical Journal* (May 11, 1907, p. 871), "The Treatment of the Bone Deformities of the Thorax and Spine in Scoliosis by Plaster Jackets, utilising Expansion of the Lungs as a Corrective Force." The introduction of the plaster of Paris jacket by Sayre has given a great impetus to the treatment of scoliosis; but, on looking back, it is curious to note the various explanations, which have been given of its practical value in the treatment of this condition. When the patient has been suspended, and the jacket put on, it has been thought by some that the improved position, resulting from suspension, has been maintained by the pressure of the plaster. Others have looked upon the jacket merely as a support to a weak spine, and its method of action has been described as follows:—A plaster of Paris jacket, properly applied, should consist of two truncated cones, the bases of the cones being at the pelvis and around the chest, just beneath the axillæ, the waist being the narrowest part of the jacket. It was thought that the weight of the shoulder girdle and the head and neck could be transmitted direct to the pelvis by this means. But a moment's reflection will show that no jacket can be so tightly fitted as to produce this effect, and, further, it is impossible to support a spine by any apparatus, which takes its upper bearing on the axillary folds. Apart from the question of irritation of the skin and soft parts, the shoulders are easily displaced upwards for 2 to 3 inches; so that one of the first principles of apparatus is violated, namely, that the point of support must be a fixed and firm one.

We are now beginning to see that plaster of Paris jackets do not fulfil the purposes for which they were designed, but we recognise that we can make good use of them, if we revert

to fundamental physiological facts. This is what Drs. Hoke and Andrews have not unsuccessfully attempted to do.

One of the writers (Dr. Hoke, November, 1903) reported the case of a young lady, upon whose ribs he had operated, in order to correct a very bad deformity of the chest, the result of scoliosis. He naturally attacked the convexity of the ribs, with a partially successful result; but his operation, of course, failed to enlarge the concave or flat areas, and he has therefore resorted to the use of a plaster jacket in a special way for this purpose.

When any portion of the lung tissue is impaired, it is found that the expansion of the chest is diminished over the affected area. It is not, as a rule, the disease *per se* that flattens the chest wall, but the change is due to the diminution of the normal respiratory movements. We are also acquainted with compensatory expansion of a portion of the chest wall, when disease is present in another part of the chest. In the normal individual, if the hands are laid gently on corresponding areas of the chest, and the patient is directed to breathe deeply, equal expansion of the chest beneath the right and the left hand is appreciable. If now, for example, the left hand is pressed gently upon the chest, not only is the expansion beneath that hand lessened, but also the chest wall, beneath the right hand, expands more forcibly than normal.

For the purposes of description of the following simple experiments, we may divide the transverse section of the chest at any given level into four segments. Two of these are situated in front of the transverse diameter of the chest and two behind. The two in front are called right and left anterior half, and the two behind right and left posterior half. Now, if a normal person stands and bends the head and the body to the left, so as to assume a right convex scoliosis viewed from the back, the result upon the expansion of the chest is as follows:—The right anterior half expands much less than the normal, and the left anterior half much more; while the expansion of the right posterior half is not only greater than that of the left posterior half, but is also more than normal. The explanation is as follows:—The decreased expansion of the right anterior half is due to the fact that the right intercostal fasciæ and muscles, and the anterior

abdominal muscles, are put upon the stretch. As a result, the right anterior half of the chest is more tense than normal, and this increase of tension is sufficient to prevent the natural expansion. The right posterior half expands more than normal because of the lessened expansion in the right anterior half. The left posterior half is prevented from expanding, because the movements of the ribs are limited in the concavity of the scoliosis, but this limitation results in compensatory expansion of the left anterior half.

Now it is found that, in a right dorsal scoliosis, the shape of the chest is always altered. Instead of its transverse diameter forming a right angle with the antero-posterior median plane of the body, it becomes oblique, so that its right-hand extremity is swung backwards, and its left-hand extremity is swung forwards. Further, the ribs of the right anterior half of the chest are flattened, and those of the right posterior half of the chest are more convex than normal, while those of the left anterior half of the chest are more convex, and those of the left posterior half are flattened.

The conditions are naturally reversed, if the individual, instead of bending his body to the left, bends it to the right. Whatever the original cause of the lateral bending of the spine may have been, a definite alteration in the shape of the chest wall results in each case. We have new prominences in parts, with excessive flattening in others, and it is plain that the effects must be continuously neutralised when we undertake the treatment of scoliosis.

In the application of plaster jackets, these points must be borne in mind. It is evident that, wherever a plaster jacket touches the chest, it limits the expansion at that spot, and if any area of the chest is left uncovered by the plaster, it commences to expand. Also, if the jacket covers the chest entirely, it prevents the whole area of the chest from proper expansion. During the last three years, considerable progress has been made, and fairly satisfactory results have been obtained, by the forcible reduction of the deformity in scoliosis. This method, briefly, consists in extending the patient in the horizontal position, and applying pressure on the convexity of the ribs, with counter-pressure on the pelvis and shoulder on the opposite side, in such a way as to diminish the lateral

displacement and rotation of the spine. A plaster of Paris jacket is then applied over the whole area of the chest. A valuable point in the treatment, which has been made by Drs. Hoke and Andrews, is this :— When the plaster is hardened, it is cut away over those areas of the chest which are unduly flattened. The result is that, so long as the jacket is worn, the respiratory expansion is concentrated upon the flattened areas, which are now free to respond, while the plaster over the prominent parts limits the expansion of the lung beneath them very considerably. The cases referred to show great improvement in the shape of the thorax, marked decrease in the rotation, and lessening of the spinal curvature.

To put the whole matter simply. By reversing, under pressure, the method of respiratory expansion in scoliosis, we have a most powerful means of altering the shape of the deformed thorax, and consequently of the spinal column itself. For it must be fully recognised that we can only bring pressure to bear upon the spine through the ribs, and indirectly.

THE OPEN-AIR TREATMENT OF SURGICAL TUBERCULOSIS.

In the *Sixth Annual Report of the New York State Hospital for the Care of Crippled and Deformed Children,* the question of the comparative value of sea *versus* inland air in the treatment of external or surgical tuberculosis is alluded to. A dry climate is essential. The ideal site comprises a surrounding country which is well wooded, if not mountainous, a suitable isolated elevation, with good natural drainage, and a position where there are many currents of fresh air. Other things being equal, the more remote these ideal conditions are from the sea the better. The inherent dampness of the sea air and the shore, coupled with the yielding nature of the sand, which makes locomotion difficult, contra-indicate the seashore as a permanent residence for patients with tuberculous joint disease.

An experience of nearly forty years, in the treatment of tuberculous joint and spinal conditions, leads the writer of the report to say that, even among the wealthy, who can command the resources, necessary to secure ideal surroundings, the

sea-shore does not afford the best climatic conditions for the treatment of chronic disease of joints.

While we are not disposed to entirely agree with the writer upon the points he has raised, we think that the best possible combination is obtained where the sanatorium is placed on high ground two or three miles away from the sea-coast, and in that part of the country which has the smallest rainfall. Such conditions are best secured in England in the eastern and south-eastern counties.

TORTICOLLIS.

Drs. E. H. Bradford and J. W. Sever, in *The Results of the Treatment of Cases of Acquired and Congenital Muscular Torticollis, at the Boston Children's Hospital since* 1879, discuss the subject from a broad outlook. It appears that ninety cases have presented themselves to the writers, and seventy-two have been operated upon, so that their statements are founded upon a wide experience. They limit their observations to purely muscular torticollis, and they have found that, in children from two to twelve years of age, it is easily cured by appropriate methods, the result is immediate, and no post-operative gymnastics are needed, so far as the cure of the deformity itself is concerned.

It is sufficient to completely divide the sternal and clavicular origins of the sterno-mastoid, while section of the scaleni is seldom called for. In their opinion, the simple transverse incision is the best, and gives rise to the least scarring. They have not found it necessary to remove the entire muscle, and, when the section of the muscle is properly carried out, the after treatment is simple, and of no long duration.

As to the cause of congenital torticollis, the writers do not find that hæmatoma is a constant factor. The theory of a hæmatoma of the sterno-mastoid being the sole cause has been disproved by Whitman and the present writers, and Witzel has shown by experiments on animals, that the artificial production of a hæmatoma is not followed by contraction of the muscle, either transitory or permanent. The most plausible and reasonable theory, which has yet been advanced, is that of Nové-Josserand and Vianny, who believe that we are dealing with an ischæmic condition. By a series of autopsies

on cases of congenital torticollis in babies, with careful dissection of the sterno-cleido-mastoid muscle and its blood supply, followed by injection experiments on the arteries, they have shown that the sternal head normally receives a smaller amount of blood than that furnished to any other portions of the muscle. With the head flexed and rotated to the position, which it would normally assume *in utero*, the arterial supply is much diminished, or wholly cut off, owing to the pressure on a small vessel, which passes from the superior thyroid artery to the sternal head of the muscle. This results in a degeneration of muscular fibres, with subsequent sclerosis and contraction. On examination, this portion of the muscle is seen to be affected with interstitial degenerative myositis, and the muscular fibres present a waxy hyaline condition. Now this is exactly the state of the muscles, when a limb is the subject of the ischæmic paralysis of Volkmann. It is always due to a slowing down, or stopping of the arterial circulation, either by tight bandaging, or by any other cause of pressure on the vessels. The asymmetry of the face, which is so constant a symptom in congenital torticollis, is said to be due to faulty nutrition, following on compression of the carotid artery, and to the displacement of the epiphyses of the basilar portion of the occipital bone.

The methods of treatment are then carefully considered, and the authors naturally favour the open method, to the entire exclusion of all forms of subcutaneous tenotomy. They discuss section of the sterno-mastoid immediately below the mastoid process, at its middle, and at its origin from the sternum and clavicle; and they prefer the last-named. It is desirable to plan the incision, in such a way that the scar will come just above or below the clavicle, and parallel with it. In order to ensure the proper position of the scar, it is advisable to pull the skin up slightly before incising it. It is essential that the whole of the muscle should be severed, and the muscular division should be made half an inch above the origin. They do not advise that attempts should be made to divide any bands of the deep cervical fascia lying beneath the muscle. They record a case, in which such a proceeding was complicated by a wound of the internal jugular vein, and it was necessary to ligature that vessel. But the present writer

(A. H. T.) has often found it essential to divide bands of the deep cervical fascia which lie posterior to the muscle. In one case Bradford and Sever found that the scalenus anticus required section.

After the sterno-mastoid has been cut, the surgeon, or his assistant, should take the patient's head in both hands, and, with the shoulders held firmly, the head should be twisted into an over-corrected position. In this way, all contractions in minor muscles are stretched. It is found, by experience, that there is a great tendency for the scar to widen as the patient regains the full use of the muscle. The present writer (A. H. T.) has obviated this by putting in tension sutures, and by keeping the scar covered with gauze, soaked in collodion, for three months after the operation.

With reference to the after-treatment, Doctors Bradford and Sever do not find that gymnastics are necessary. They employ two methods: by fixing the head in an over-corrected position by strips of adhesive plaster; or by using plaster of Paris bandages, which should be worn for at least three months after the operation.

CONGENITAL DISLOCATION OF THE HIP.

Mr. W. E. Bennett has written, in the *Birmingham Medical Review* for October 1906 and March 1907, an interesting article, giving his experience of the treatment of these cases. He speaks, at considerable length, of the ætiology of the affection, and favours Dupuytren's view, which presupposes extreme flexion of the fœtal thighs and lax muscular and ligamentous tissue. The result is that the head of the femur tends to slip on to the rim of the acetabulum. If this occurs, the rim, as the spot where the pressure is exerted, does not grow at the same rate as in the remainder of its circumference. So that, at birth, the head is lying on the atrophied rim, and it is a chance whether the first movement sends it in or out.

In writing on the pathology of the affection, Mr. Bennett is in agreement with the other authorities. But he alludes to a point which, in our opinion, is of vital importance, namely, the great strength of that portion of the capsular ligament running down to the small trochanter, and the influence of the ilio-psoas tendon in pulling the head of the femur upwards. We have

found, in performing the open operation for this condition, that the head cannot be replaced until these structures are divided.

In the diagnosis of the affection, it is often difficult, in small children, to determine the relation of the trochanter to Nélaton's line, and it is not always easy in adults. Mr. Bennett has, consequently, adopted what is now known as McCurdy's line. It is one that crosses the pelvis through the spines of the pubic bones at right angles to the median line, the umbilicus serving as the vertical of the triangles. This line extends outwards across the hip joints, passing above the trochanteric eminences in the normal condition. A second line is now drawn across the pelvis, from the tip of one great trochanter to the tip of the other. If the two lines mentioned are parallel, no displacement exists, but, if the lines converge, displacement of some sort will be found on the side where the lines are closer.

It is of interest to ask if any form of new acetabulum is ever produced in an unreduced dislocation. Mr. Bennett says that he has never met with an instance in the double variety, where any positive evidence of such could be obtained, either by the ordinary clinical methods of examination, or by radiography ; whereas he believes that, in some unilateral cases, a lump of bone is thrown out, which limits the further excursion upwards of the head of the bone.

The method of treatment, which the writer favours, is Lorenz's modification of Paci's original proceeding, and he notes the tension of the hamstring muscles and flexion of the leg as a test of the complete replacement of the head into the acetabulum. He has operated upon 27 cases in two years ; ten were bilateral, and six of these showed immediately good anatomical results on both sides, three showed similar results on one side only, and, at a subsequent operation, the hip on the other side was reduced in each case. Of these three, two now show good results, and in one, the head of the femur remains transposed in the subspinous position. One case, at the operation, gave an immediately good result, but subsequently entirely relapsed, which appears to have been due to the indifference and carelessness of the parents. Of the 17 unilateral cases, 14 gave immediately good anatomical results,

two are subspinous repositions, and one was a failure. With regard to function, the result in 10 cases is excellent, in eight, the result is described as being good, and in four, as moderately good.

In the *Journal of the American Medical Association*, January 26, 1906, Frederick Müller describes a "New Primary Position in the Bloodless Treatment of Congenital Hip Joint Dislocation." He points out that there is one spot, at which the head can be made to enter the acetabulum, and this is in the posterior superior quadrant of the socket. This spot is designated "the recessus." In old standing cases, the neck of the femur is so twisted that a condition of coxa vara is produced. If the attempt is made to reduce the head of the bone with the patella to the front, failure often results, because the long axis of the recessus and that of the head and neck of the femur do not coincide. Now, if the limb is rotated through 90°, so that the patella points directly inwards, the axes are the same, and the head readily slips in. This is a fact, which has been well known for some three or four years to orthopædic surgeons. It can therefore be scarcely claimed as original by Dr. Müller, and a perusal of the discussion on his paper bears out this contention.

FLAT FOOT.

The subject of flat foot has occupied a considerable space in the literature of the past year. Among the articles worthy of perusal are "The Pronated Foot and its Clinical Significance," by S. T. Pope (*Californian State Journal of Medicine*, December 1906). "Pes Planus from the View Point of Neurology," by Charles B. Frischbier (*New York Medical Record*, January 12, 1907). "Some Remarks on Deformities of the Arch of the Foot and of the Toes," by Edred M. Corner (*Clinical Journal*, August 29, 1906). "An Improved Form of Brace for Treating Flat or Weakened Conditions of the Foot," by J. M. Berry (*Albany Medical Annual*, August 1907). "A Careful Statistical Study of the Relation between the Height of the Longitudinal Arch and the Functions of the Foot," by Dr. Philipp Hoffmann (*Interstate Medical Journal*, August 1907). But the most valuable contribution is that by Dr. Royal Whitman, entitled "A Consideration of the Causes and the Characteristics of

the Weak Foot with Reference to the Principles that govern its Treatment." This article appears in the *New York Medical Record*, August 31, 1907.

Whitman dislikes the use of the term pronation, partly because pronation is usually understood to imply an attitude of activity, while the characteristic of the weak foot is inactivity, which finds its expression both in eversion and abduction. He further adds that the term pronation has the disadvantage of being unintelligible to medical students. It may be briefly said that by pronation is meant an everted and abducted foot, but not necessarily a flattened arch. In Dr. Whitman's opinion, the terms weak foot and flat foot are not synonymous. He recognises at least three classes :—(1) the abducted foot, in which the arch is well formed ; (2) the abducted and flat foot, in which the arch is lowered ; (3) the flat and abducted foot, where the foot is "flat."

The prognosis as to cure is favourable in the order of the classes. In the first case, one has to do simply with an improper attitude, which, when extreme and persistent, is usually a direct result of injury ; in the second, the lowering of the arch indicates long duration of deformity, and, consequently, secondary changes in the tissues. The third class includes the final effect of the two others, as well as those cases, in which the arch has always been low, or in which flatness was acquired at an early age. Dr. Whitman points out that the positions of strength and activity in the foot are adduction and inversion ; while the positions of fatigue, weakness, and rest are abduction and eversion. The deformity of the weak foot is an abnormal persistence, or exaggeration, of the attitude of abduction or rest. The abduction is primary, and lowering of the arch is the secondary element.

He says that the predisposing causes of the weak foot are :—(1) Congenital or acquired abnormality, or weakness of structure, the support being deficient ; (2) weakness of muscles, the power being insufficient ; (3) over-weight or over-strain, the burden being too great ; (4) improper attitudes that subject the foot to a mechanical disadvantage in the performance of its functions, the adjustment being imperfect. He alludes to the circulatory disturbances, so frequently seen in flat foot, and the present writer (A. H. T.) has noticed and recorded the

association of weak or flat foot with varicose veins, cold and clammy skin, and a feeble cardiac beat.

In the treatment of the affection, Dr. Whitman proceeds from the consideration of the mild to the severe types. The boot should have a well-pronounced inward twist, and be fitted with a valgus wedge. Outward rotation of the limbs must be avoided. The foot should be advanced in the line of the walk, and a springy step cultivated. In the sitting posture, the patient should always cross the feet, so that the weight resting on the outer borders should incline them inwards, or invert the soles. He also discusses the value of inversion and tiptoe exercises, and goes at great length into the fitting of his well-known brace, which is now becoming almost indispensable in the treatment of certain forms of flat foot. A plaster cast of the foot is taken with proper precautions, and on this the brace is modelled. Its principle is as follows:—The foot is placed as it were in a saddle, which prevents the lateral spreading and bulging on the inner side, which characterise all grades of the deformity. This positive effect is increased by slight leverage action, for the outer flange bears weight, and is pressed down, and in consequence pushes the inner flange slightly upward against the foot at the moment of greatest strain. The sole part of the brace supports the foot, but the principal pressure, often shown by thickening of the skin, will be on the inner side of the foot. And there is an entire absence of the hollowed-out atrophied appearance of the sole, which is so often present, when simple direct support, such as is made by rubber pads, is used.

Finally, the treatment of the most severe forms is briefly reviewed, and Dr. Whitman favours tenotomy and overcorrection, with the subsequent use of plaster.

SUBACUTE AND CHRONIC MIDDLE-EAR DEAFNESS.

By MACLEOD YEARSLEY, F.R.C.S.,

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In spite of the fact that considerable progress has been made, in recent years, in the classification and treatment of deafness, due to middle-ear conditions other than suppuration, a great deal of confusion still exists upon the subject in the minds of the bulk of the profession. I propose to give some account of the more common of the two conditions, from which subacute and chronic middle-ear deafness may arise, together with a description of its varieties, symptoms, and treatment.

The two conditions alluded to are chronic catarrhal inflammation of the middle-ear tract, and otosclerosis. The latter is one which has been, and apparently still is, largely confounded with the former. It is questionable whether pure otosclerosis is really a disease; the strong element of heredity, which is a definite factor in its onset, is, in the light of the biological law of heredity, which denies the transmission of disease, decidedly against such a view. Otosclerosis is characterised by an insidious progressive deafness, nearly always hereditary, much more common in women, appearing in young adult life, and due to an affection of the bony labyrinthine capsule with normal tympanic membrane and patent Eustachian tube. Its symptoms and functional tests point to a fixation of the stapes, and, in every case, in which the morbid histology has been definitely ascertained, the stapes has been found to have been rendered immobile in the oval window by new bone, together with the presence of osteophytic outgrowths in the cochlea, and often with the formation of foci of spongioid bone in the compact tissue of the capsular walls. Otosclerosis is very intractable to treatment, and there is, at present, no sure means of dealing with it successfully. It is not my intention to further discuss this condition here; but it is owing to the fact that the later stages of many cases of chronic catarrhal inflammation of the middle-ear resemble

it in symptoms, that confusion has arisen, and hence it is necessary to insist upon the importance of otosclerosis as a very definite entity, before entering upon the consideration of the more common condition.

In striking contrast to otosclerosis, chronic middle-ear catarrh is inflammatory in nature. The secret of its successful treatment lies in this knowledge, and in dealing with those abnormal conditions of the nose and throat, which are its chief causes. Unfortunately, the majority of persons suffering from gradually increasing deafness, do not usually seek skilled assistance sufficiently early to enable their condition to be dealt with, before the later stages of the inflammatory process have begun. This is partly because they hope to get well without aid, partly due to the fact that it is only when the second ear has become implicated that they realise the serious involvement of the one first attacked.

The primary cause of chronic middle-ear catarrh is catarrh of the upper air passages; hence anything which promotes this condition will act as a subsidiary cause. The majority of cases begin in early life, the reason being that adenoids, essentially a disease of that period of existence, is one of the most fruitful sources of the condition. The classification of the causes of catarrh of the upper air passages may be made as follows:—*General:* (1) Exposure to wet and cold; (2) anæmia and plethora; (3) diathesis (gout, rheumatism, syphilis, etc.); (4) exanthemata. *Local:* (1) Hypertrophy of the lymphoid ring of Waldeyer (adenoids, enlarged tonsils); (2) secondary syphilis; (3) œdema and hypertrophy of the turbinal bodies; (4) septal deflections; (5) atrophic rhinitis; (6) nasal polypi, etc.; (7) suppuration in accessory nasal cavities; (8) irritation of the nasal and naso-pharyngeal mucosa by smoke, dust, etc.

The most important of the foregoing are adenoids, enlarged tonsils, and other forms of nasal obstruction. These conditions act by keeping up the catarrhal state rather than mechanically, although they sometimes also act in the latter manner, chiefly by interfering with the proper action of the palatal and tubal muscles. One of the best illustrations of the way, in which nasal obstruction acts in keeping up the catarrhal condition, is to be found in the persistence of adenoids in the adult. The rapid enlargement of the naso-pharynx, at the onset of

puberty, generally leaves the pad of adenoids, which formerly filled the cavity, much smaller, although the difference is more apparent than real. Hence the symptoms of obstruction (assuming that there is no concomitant nasal hypertrophy) become ameliorated, whilst the ear condition progresses on account of the frequent attacks of nasal and post-nasal catarrh, induced by the presence of the adenoids.

The pathological changes in middle-ear catarrh may be divided into four stages :—(1) Chronic congestion and exudation ; (2) proliferation ; (3) fibrous contraction ; (4) cicatrisation (" post-catarrhal " stage).

We have only to consider, for one moment, the peculiar anatomy of the tympanic cavity in order to realise the effects of catarrhal inflammation upon it, and upon the proper working of the ossicles and muscles contained in it. In the attic surrounding the articulations of the ossicles, and intervening between their ligamentous attachments, are tiny pouches of mucous membrane, in which even a small amount of swelling is a serious matter for the efficient working of the mechanism of sound conduction.

Let us briefly consider the four stages enumerated above.

In the *stage of congestion and exudation,* there is engorgement of the vessels, with exudation into the subepithelial layer. Occasionally, this exudation is sufficient to pass into the tympanic cavity, forming a serous, mucous, or sero-mucoid accumulation. Such a condition is unusual in this country, although it is very common in America. If resolution occurs, the vessels are relieved, and the exudation is carried off by the lymphatics, if there is no such happy ending, engorgement and exudate remain, and the condition passes into the *stage of proliferation* of cell elements, in which new fibrous tissue is formed in the subepithelial layer as a result of the chronic inflammation. As this develops, the new tissue commences to contract, and the stage of contraction is reached, resulting in the binding down of ossicles and muscles by bands of adhesion, the reduction of the lining membrane of the tympanum to a mass of contracted fibrous tissue, and the narrowing of the lumen of the Eustachian tube. Finally, this third stage passes insensibly into the *stage of cicatrisation* or post-catarrhal condition.

The effect of these changes is to greatly hamper the action of the tympanic membrane, ossicles, and intratympanic muscles. The membrane, in the earlier stages, may be merely depressed, owing to the interference with the proper ventilation of the tympanum by the congestive Eustachian obstruction, its texture and lustre remaining unchanged. Later, the in-drawing is partly due to the permanent narrowing of the tube, partly to the contraction of ligaments and bands of adhesion, so that the malleus is drawn backwards and inwards, and twisted, or even fixed, by the cicatricial contraction of ligaments. and tensor tympani tendon. Its lustre is lost, its texture thickened, with, perhaps, calcareous plaques and patches of atrophy. Similarly, bands of adhesion, passing from the sides of the fossula ovalis to the head, or crura of the stapes, may fix that ossicle, and consequently cause a marked degree of deafness. The intratympanic muscles, especially the tensor tympani, become much weakened in their action, partly by the interference of bands of adhesion, partly also by a myositis of the muscles themselves.

The symptoms of chronic catarrhal inflammation of the middle-ear tract vary, according to the stage reached by the condition, and according as it affects the Eustachian tube alone, or chiefly, or the whole middle-ear tract. The artificial distinctions, made in some text-books between Eustachian obstruction and middle-ear catarrh, are responsible for much of the confusion that has arisen in the proper comprehension of these conditions. When once it is fully appreciated that there is but one condition, the symptoms of which vary according to the part of the middle-ear chiefly affected, and the stage reached by the inflammatory process, all difficulties vanish.

When the condition chiefly affects the Eustachian tubes, the symptoms are almost wholly referable to the obstruction thus caused. The tube may be affected at its pharyngeal opening only, or in its whole length, and a tube, affected in the former manner, may later be involved throughout its length by the spread of the catarrh. There is marked deafness on one or both sides, generally with irritation in the tubal region. On swallowing, or blowing the nose, there may be an amelioration for a few moments, heralded by a crack in the ears. With the deafness is more or less tinnitus, usually of a dull, rushing

character, with a full, oppressed feeling in the head, and autophony, or the hearing of one's own voice in the ears, as if the head were shut up in a box. As the causative cold becomes less, the hearing may be restored with a sudden crack, due to the parting of the opposed surfaces of the tubal mucosa. In first attacks, this restoration, or the effect of inflammation, is immediate and permanent, but, in later attacks, it becomes less and less, until the patient reaches a stage of chronic, permanent deafness. The diagnosis and prognosis of tubal obstruction mainly depend upon the result of inflation, and the appearances of the membrane, which is indrawn and normal in texture and lustre.

The treatment of Eustachian catarrh resolves itself into that of the cause (removal of the conditions leading to catarrh of the upper air passages and general constitutional measures), and that of the effect. The latter is a question of inflation, the use of the Eustachian bougie, and intra-tubal injections. Here a few words are necessary upon the important subject of the mode of inflation. I have long given up the use of the Politzer bag, save in a few isolated cases. It is a dirty and unscientific method. One never knows, although the nasal passages may first be carefully cleansed, what one may blow into the ears, nor the exact force one may be using. I have seen a house surgeon rupture an atrophic membrane by too forcible Politzerisation, and I feel sure that the superfluous force, which the Politzer bag requires, is spent in overstretching the tympanic membrane. I habitually use the Eustachian catheter for all inflations. It is clean, the force of inflation can be regulated to a nicety, and, further, the Eustachian bougie can be passed through it, or an intra-tympanic injection made by its means. Eustachian bougies are passed, after dipping in a sterilised oily fluid, along the catheter into the tube ; they are then allowed to remain for two minutes before withdrawing, followed by gentle inflation. Whether the bougie is used or no, it is well to inject, through the catheter, a few drops of parolein, preferably containing 5 per cent. of menthol. Two or three drops are introduced into the wide end of the catheter, and inflation performed ; by this means, the fluid is sprayed into the Eustachian tube, and, by its oily nature, prevents the opposed mucous surfaces from becoming again adherent.

When the catarrhal inflammation affects the whole middle-

ear tract the signs and symptoms depend upon the stage which the process has reached. In the congestive stage, the severity of the symptoms is dependent upon the amount of exudation. Cases with exudate in the tympanic cavity are decidedly uncommon in this country; indeed, during an experience of over fifteen years, I have not seen more than ten such cases. When, however, exudate is marked, there is marked deafness, with a feeling of fulness, bubbling tinnitus, autophony, and general vertigo. In the absence of fluid exudation into the middle-ear, the symptoms are less severe; there are deafness and tinnitus with crackling, and the improvement, attendant upon inflation, is more marked than in the former type of case. Upon examination, in cases with exudation, the membrane of Shrapnell and the manubrial plexus are injected, and the exudation shows itself as a dark line running across the membrane in a slight curve, with the concavity upwards. When this exudate is very fluid, the line may vary with the position of the patient's head. It may contain bubbles of air, which can be seen through the semi-transparent membrane, sometimes giving it almost the appearance of Gruyère cheese. Sero-mucoid exudate may cause bulging of the membrane, with a slightly yellowish reflex. When no exudation is present, the membrane appears slightly injected along the handle of the malleus, and may be also slightly indrawn.

The treatment of the congestive stage of catarrh, affecting the whole middle-ear tract, is both causative and local. Any abnormal condition in the nose or naso-pharynx should be sought for and corrected, but, especially in cases with marked exudation, operation should be postponed until the aural condition is less severe, a nasal alkaline douche being used meanwhile. In both varieties, inflation should be practised. When there is exudation of a very fluid character, it may be evacuated by inflation with the patient's head inclined to the opposite side, but, when it is mucoid and tenacious, it is not so easy to remove. This may sometimes be accomplished by means of an intra-tympanic injection of a warm, mild, alkaline solution, but it is occasionally necessary to incise the membrane and remove the exudate, by mopping with a wool-armed probe. The question of incision, followed by the blowing out of the exudate by inflation, is a debated one. If

there is any difficulty, for my own part, I do not see that there is any risk, provided the inflation is done by means of a clean catheter, through a previously carefully cleansed nose. It may sometimes be sucked out by means of a Siegle's pneumatic speculum. After the removal of the exudate, counter-irritation behind the ear is of advantage.

The stage, just described, is really one of subacute inflammation, but it is best to describe it here, because it is but an early manifestation of the same process, and may lead to the more chronic stages, if allowed to go untreated.

The symptoms of the *stages of proliferation and contraction* are best taken together. The history is usually one of repeated attacks of deafness, generally due to colds, the first attacks interrupted by periods of good hearing, but each succeeding attack being longer in duration, and less perfectly recovered from, until a time is reached when the deafness becomes permanent, and is worse after each fresh cold. There may, however, be no history of repeated colds, but one of slowly increasing loss of hearing, due to the gradual extension of chronic post-nasal catarrh. In both, the deafness is accompanied by varying tinnitus, of a hissing, or buzzing character, and there are, in these later stages, certain added symptoms. These are paracusis Willisii (hearing better in a noise), diplacusis, paracusis loci (difficulty of locating sound) and otomyasthenia. The last-named symptom is due to the weakening of the intratympanic muscles, so that the patient is unable to accommodate his hearing to one particular sound, when other sounds are going on around him.

On examination, the membrane is usually thickened, and often indrawn by the contraction of adhesions. Its mobility, as ascertained by the pneumatic speculum, may be impaired, the malleus completely or partly fixed, or there may be a general or partial laxity of the membrane, especially in the superior posterior segment, due to overstretching, by injudicious inflation by Valsalva's method, on the part of the patient.

The functional tests give the reactions peculiar to middle-ear deafness, namely, a negative Rinné, increased bone conduction, and loss of acuity by air conduction for the low tones of the scale. In the earlier stages of chronic catarrhal inflammation, Rinné's test is negative for the forks up to and below

C. 128, whilst, as the deafness becomes more marked, it becomes also negative for the C^2 512. Increase of bone conduction is characteristic of pure middle-ear deafness; in later stages, when intra-labyrinthine changes have taken place, some loss of bone conduction, usually not more than −10 or −12 seconds, will be found. A markedly negative Rinné, in conjunction with increased bone conduction, and a reduction in the hearing for low tones, is pathognomonic of fixation of the stapes: any doubt upon this score can be removed by the employment of Gellé's test.

Hearing for acoumeter, voice, and whisper is reduced in proportion to the loss of air conduction, the loss for the whisper being usually more than that for the spoken voice.

The treatment of the later stages of catarrhal inflammation of the middle ear is looked upon by many persons as highly unsatisfactory. This is either because it has been improperly carried out, or entered upon too late, or because cases of otosclerosis have been confounded with the simpler catarrhal inflammation. I am inclined to think that careful and judicious treatment will more often than not be attended by success. It is quite true that there are many failures, but I believe that numbers of cases are allowed to go untreated, or are only treated in a half-hearted manner, because of the idea that exists in many minds that treatment is useless.

I shall consider the means at our disposal under the heads of internal remedies, the restoration of the permeability of the Eustachian tubes, and of the mobility of the ossicles, and the correction of abnormal conditions of the nose and post-nasal space. One of the most valuable internal remedies is strychnine, and I have found that it is specially indicated when otomyasthenia is present. It must, however, be given in fairly large doses. It is quite useless to prescribe it in the form of Easton's syrup, or any similar preparation; it should be administered either as the B.P. Liquor, or in tabloid form. I prefer to employ the latter, commencing with one tabloid of $\frac{1}{30}$ gr. three times daily, and increasing the dose by one tabloid *per diem* until the limit of tolerance is reached. If the liquor is used, one can start with $\frac{1}{20}$ or $\frac{1}{30}$ gr. thrice daily, augmenting this dose by $\frac{1}{100}$ gr. to toleration, or until $\frac{1}{10}$ gr. or $\frac{3}{25}$ gr. is taken thrice daily. In many cases, this treatment will add to the improvement in the hearing, obtained by other

means, and diminish the tinnitus. Another valuable remedy for tinnitus is dilute hydrobromic acid. This is especially useful when the noises are of a pulsating character, and may succeed when strychnine fails. It requires to be given in doses of from ʒss. to ʒj. or ʒjss., and may be prescribed alone, or in conjunction with strychnine. Other useful remedies for tinnitus are valerian (in full doses of the ammoniated tincture), iron and arsenic (in anæmic cases), and Carlsbad salts (in gouty persons). The importance of attention to general constitutional treatment by hygienic and other measures must never be lost sight of.

As regards the restoration of the permeability of the Eustachian tubes, inflation is one of the most valuable methods we possess. For the reasons pointed out, I prefer to use the Eustachian catheter in nearly every case. There is, however, another method of inflation, against which every patient should be warned, namely, *auto-inflation*. Patients should never be taught to inflate themselves, by the Politzer bag, by Valsalva's method, or by means of any of the so-called self-inflators. Patients invariably overdo it, and, finding that inflation improves them, they practise it continually, until they have so over-stretched their tympanic membranes that their hearing is made much, and permanently, worse by the lax membrane resting upon the inner tympanic wall and incudo-stapedial articulation.

The frequency of inflation is, to some extent, dependent upon the case and the progress of improvement. It is useless to inflate a chronic case, and then wait a week before the inflation is repeated, for this gives the ear an opportunity to revert to its former condition, and so to lose the advantage of any improvement. In order to obtain any permanent result, inflation must be practised daily, or, at any rate, every other day. By that means, a little more improvement is obtained each day before the previous result has quite passed off. It is my practice to inflate daily for a fortnight, then every other day for a week, then twice a week, and so on, until a fortnightly or monthly inflation is sufficient to maintain the improvement obtained.

With inflation, the injection of various medicaments, in the way already indicated, is often very useful. Of these parolein with iodine ($\frac{1}{2}$ per cent.), menthol (1 per cent.),

and iodide of potassium (gr. v. to ʒi.) are of most value. These often act best when combined with otomassage.

When much stenosis of the Eustachian tube exists, the occasional passage of the Eustachian bougie is very valuable.

In cases with much tinnitus, it is sometimes of advantage to administer, by the catheter, such vapours as ethyl iodide, acetic ether, or nascent chloride of ammonium. Otomassage, as a means of improving the vascular tone of the middle ear, of stretching adhesions, or improving the mobility of the ossicles, has proved itself of value in my hands, as a perusal of my paper, in the October number of the *Journal of Laryngology*, will show. In using otomassage, rapidity of vibration, combined with shortness of piston-stroke, is essential.

Of the numerous operations which have been suggested for chronic middle-ear catarrh, mobilisation of the fixed malleus stands out as the most valuable and successful. In one case under my care, the little manipulation improved the hearing for the whisper from 1 foot at once to 3 feet, an improvement which was maintained without further treatment. In another case, in which the watch, voice, and whisper were audible on contact, at 2 feet 5 inches, and 8½ inches respectively, the improvement on mobilisation was ½ an inch, 4 feet, and 16 inches respectively, a result increased by otomassage in the next three weeks to 6 inches, 13 feet, and 28 inches.

Finally, as to the correction of nasal and naso-pharyngeal abnormalities, much has been said and written as to the advisability of such measures in the treatment of chronic middle-ear catarrh. In cases of adenoids, enlarged posterior ends of the inferior turbinals, and the like, there can be no doubt as to the propriety of removing them. In doubtful cases, the wiser plan is to try treatment for the deafness first, and, if successful, then to advise intra-nasal operation with the object of obtaining further improvement, and maintaining that which has been already gained. Each case must, however, be considered upon its individual merits, and I may here insist upon the importance of always considering the individual as well as his ears. In some cases, in which a nasal spur, or septal deflection prevents the passage of the Eustachian catheter, it may be necessary to operate in order to admit of aural treatment.

OPHTHALMIA NEONATORUM.

By STEPHEN MAYOU, F.R.C.S.,
Jacksonian Prizeman; late Hunterian Professor, Royal College of Surgeons; Ophthalmic Surgeon to Paddington Green Children's Hospital and Hospital for Paralysis, Maida Vale; and Assistant Surgeon to the Central London Ophthalmic Hospital.

WITHOUT doubt this disease has been known from time immemorial, mention having been made of it in the Bible. But it was not until Neisser discovered the gonococcus, in 1879, and Crédé, the prophylactic treatment, in 1881, that ophthalmia neonatorum began to be diagnosed and treated with scientific accuracy.

In studying ophthalmia neonatorum, it is necessary to look at it from several points of view.

I.—Its sociology.
II.—Its anatomy and pathology.
III.—Its clinical aspect.
IV.—The complications to which it gives rise.

In discussing these, it is often impossible to entirely separate one from the other.

In dealing with the sociological aspect, I am deeply indebted to the Medical Officers of the Blind Schools and Lying-in-Hospitals in England, to the staffs of Moorfields and the Central London Ophthalmic Hospitals, and to Mr. W. I. Hancock, ophthalmic surgeon to the Shadwell Children's Hospital, for allowing me to use the notes of their cases for the statistical results given below.

I.—SOCIOLOGY.

In discussing the sociology of the disease, there are four main sources of information :—

(1) Government reports.
(2) The cases of ophthalmia neonatorum attending ophthalmic hospitals.
(3) The cases of blindness arising from ophthalmia neonatorum in the blind schools.
(4) The cases occurring in connection with Lying-in Institutions and Charities.

The prophylactic treatment of Crédé, in 1881, has led without doubt to a great decrease in the number of cases. At first, as will be shown, this decrease was very marked as the treatment became more widely known, but, for several years now, the decrease has been extremely slight, as the following tables will show. In fact, the disease is still very widespread.

Frequency. (1) *Government Reports.—The Royal Commission on the Blind,* in 1889, reported that there were about 7,000 people in the United Kingdom, who had lost their sight from ophthalmia neonatorum, and this represented about 350,000*l.* a year to the country.

The Census.—The following table shows the proportion of blindness in the population of Great Britain :—

——	England.	Scotland.	Ireland.
1861 - - -	1 in 1,037	1 in 2,820	—
1871 - - -	1 in 1,037	1 in 1,112	—
1881 - - -	1 in 1,138	1 in 1,182	—
1891 - - - -	1 in 1,236	1 in 1,439	1 in 1,048
1901 - - -	1 in 1,285	1 in 1,374	1 in 881

It is thus seen that blindness is most prevalent in Ireland, next in England, and then in Scotland. In Scotland, it is most prevalent in outlying districts like the Shetlands, probably as the result of the difficulty in getting skilled advice and treatment.

The following table shows the cases of blindness in Ireland attributed to ophthalmia, and the reduction which it has undergone through treatment :—

——	1861.	1871.	1881.	1891.	1901.
Proportion	—	1 in 3,296	1 in 9,894	1 in 12,446	1 in 22,983
Per cent. -	41·3	38·4	—	—	—
No. of cases	1,962	1,642	523	378	194

The following is an extract from the *General Report of the Census of England and Wales* (63 Vict. c. 4), 1901 :—

"The following table, which gives the proportions of blind per million living at the earlier age-groups, shows that, in the decennium 1891–1901, as also in recent previous intercensal periods, there has been a decrease in the proportion of blind children in England and Wales generally; it thus lends support to the contention, in the General Report for 1891, that the decrease is due either to less prevalence, or to more efficient treatment of purulent ophthalmia, and the other infantile maladies which may result in blindness."

Age-period.	1851.	1861.	1871.	1881.	1891.	1901.
Under 5 years	198	196	185	166	155	129
„ 5–10 „	297	256	259	288	188	192
„ 10–15 „	365	366	359		290	323

At the three censuses of 1861, 1871, and 1881, the persons making the return were asked to specify cases, in which the infirmity dated from *birth;* in 1891 and 1901, they were asked to specify cases dating from *childhood*. Therefore, in the three earlier censuses, the proportion of cases of blindness due to ophthalmia neonatorum would be larger than in the two later ones, since the cases of keratitis, phlectenular, and interstitial, which would swell the numbers in the two later censuses, would not have appeared at birth. But, in spite of this, there has been a diminution in the totally blind in the early age group.

A rough estimate of the number of cases of blindness, due to ophthalmia neonatorum under the age of 15, may at the present time be made as follows:—

Population of England and Wales in 1901 = $32\frac{1}{2}$ millions + $1\frac{1}{2}$ million (rate of increase) to bring up to 1906 = 34 millions.

Total number of blind under age of 15 per million is 323. Therefore there are (34×323) 10,982 children under the age of 15 blind in England and Wales.

The percentage of blind in the schools of England and Wales due to ophthalmia neonatorum is 27 (*see* below).

The total number of blind in England and Wales from

ophthalmia neonatorum, at the present time, is 2,965 under the age of 15.

(2) *The Cases of Ophthalmia Neonatorum attending Ophthalmic Hospitals.*—The influence of the prophylactic treatment, in diminishing the number of cases of ophthalmia neonatorum attending the hospitals, is well shown by Alvarado. In collected statistics from Glasgow, Birmingham, and Manchester, before the year 1881, out of 3,388 cases attending the hospitals, 62 suffered from ophthalmia neonatorum, that is to say, 1·830 per cent. Since 1881, cases collected from Manchester, Birmingham, Glasgow, Liverpool, and London amount to 130,532, and of these, there are 911 cases of ophthalmia neonatorum, representing ·698 per cent. The reduction from 1·830 per cent. to ·698 per cent. shows well the influence of the prophylactic treatment in preventing the disease.

The following figures, given by Alvarado, represent the collected statistics of the various ophthalmic institutions of different countries between 1881 and 1896:—

Country.	Percentage.	Country.	Percentage.
Spain	1·176	Switzerland	·932
France	1·111	Holland	1·526
Italy	1·363	Austria	·809
Russia	·353	America	·399
Germany	·60	England	·69
Belgium	1·234		

These statistics show considerable variation. In Germany, Austria, America, and Russia, where prophylactic measures and treatment are carried out very fully, and are, to a certain extent, insisted on by the State, the statistics are very low as compared with other countries.

Some individual statistics, which are perhaps of more value, are as follows:—

Fuch (Germany)	1885	1·46 per cent. in 21,440 cases.
Coln (Germany)	1896	·64 ,, ,, 302,971 ,,
Jackson (America)	1894	·40 ,, ,, 382,741 ,,
Sym (Scotland)	—	·7 ,, ,, 3,000 ,,
Mayou (London)	1906	·161 ,, ,, 337,867 ,,

With the idea of finding out the frequency at the present time, I have gone through the notes of all the cases attending the Moorfields Hospital during the last five years. Previous to this, Mr. Tyrrell, at the instance of Mr. E. Treacher Collins, has done the same, that is to say, we have a continuous record for all cases for eight years shown in the table following :—

MOORFIELDS.

Year.	No. of Cases of O.N.	Outpatients.	Percentage.
1899	65	37,832	·171
1900	77	36,932	·208
1901	91	31,258	·290
1902	48	32,442	·147
1903	52	39,752	·130
1904	50	43,038	·116
1905	72	42,336	·170
1906	47	37,868	·124
Total	502	301,458	·166

To control these figures, the outpatients' letters of the last three years of the Central London Ophthalmic Hospital were investigated with a very similar result. The figures were as follows :—

CENTRAL LONDON OPHTHALMIC HOSPITAL.

Year.	No. of Cases of O.N.	Outpatients.	Percentages.
1904	11	12,820	·085
1905	30	12,539	·239
1906 (August)	16	11,050	·144
Total	57	36,409	·156

Adding both these results together we find :—

Total of both hospitals=	559	337,867	·161

It will be noticed that there has been a considerable drop in the number of cases of ophthalmia neonatorum attending ophthalmic hospitals recently, as compared with the statistics,

given above by Alvarado, for the previous decade ; that is to say, they have dropped from ·6 per cent. to ·161 per cent. But, at the same time, the numbers for the last eight years show a comparatively small decrease ; although these latter statistics compare very favourably with other countries, the percentage is extraordinarily high considering the prophylaxis and curability of the disease.

(3) *The information obtained from the blind schools* is probably the most valuable of all, as it represents the results of the disease. In an address at the Mansion House in 1897, Mr. Tweedy gave the percentage of blindness due to ophthalmia neonatorum in the institutions of England as being over 30 per cent. With the idea of finding out whether the number had decreased, and also of finding out the proportion at present in the schools, I wrote to all the medical officers of these institutions. Out of 2,569 blind inmates of these schools, 706 were definitely blind from ophthalmia neonatorum ; making, that is to say, 27 per cent. These children were all under the age of 18. In examining these statistics, a great variation was found, but allowing for cases, in which the cause was not definitely known, although the clinical results were indistinguishable, it appears that there is great variation in different districts, which no doubt partly depends on whether the prophylactic treatment is carried out or not by the midwives and doctors in those districts. Only in two instances, could I obtain statistics which showed any direct influence of the prophylactic treatment, and in only one instance, namely, Henshaw's Blind Asylum, Manchester, could these statistics be relied on. Dr. Glascott, who is ophthalmic surgeon to that institution, tells me that, in the year 1890 (that is to say, before the prophylactic treatment could have had full effect), the percentage of blindness due to ophthalmia neonatorum was 39 per cent., whereas, at the present time, the percentage is only 8·9, which is the lowest of any school in England ; a fact which is probably due to the very rigorous way in which the prophylactic and curative treatment is carried out in the Manchester district, owing to the exertions of individual enterprise.

In the London board schools, Dr. James Kerr, some years ago (after the prophylactic treatment had been introduced), found the percentage to be 40. More recently, N. Bishop

Harman found it to be 36·86 ; that is to say, there is a slight decrease in recent years. In Birmingham (Dr. J. A. Berlyn), the following figures show the disease to be fairly stationary from 1892 to the present date :—

1892–1896	-	-	-	-	24·1 per cent.
1897–1901	-	-	-	-	21·8 „ „
1902–1906	-	-	-	-	23·2 „ „

These observations, on the schools for the blind of England, go to show that there was a considerable decrease in the number of children admitted, commencing suddenly about ten years after the introduction of prophylactic treatment, and varying considerably in different districts. This decrease continues, to a much less extent, right up to the present time, but ophthalmia neonatorum still causes an enormous and unnecessary proportion of blindness in England, namely, 27 per cent. of the blind under the age of 18 years.

(4) *Cases occurring in connection with the Lying-in Institutions and Charities.*—In studying the returns of the Lying-in Institutions, it must be remembered that they show rather the results of the prophylactic treatment and the preventability of the disease than its actual frequency, since most rigorous regulations are in force in most institutions in this country.

To Crédé we are indebted for the great diminution in ophthalmia neonatorum at the present time. In 1881, he found by dropping a 2 per cent. solution of nitrate of silver into the eyes of newborn infants that the percentage of the disease was reduced from 9·97 per cent. in 2,266 births to ·086 per cent. in 1,160 births.

Kostling confirms these results by collected statistics. In 17,000 births, the percentage of ophthalmia neonatorum was 9 before the prophylactic treatment was used. After the treatment was used, it was reduced to ·65 in 24,000 births.

The results of the prophylactic treatment have been fully confirmed by British observers. With the idea of finding out the number of cases occurring in connection with these institutions at the present time, and also of ascertaining the methods adopted for the prevention of the disease, I wrote to the Medical Officers of all these Institutions throughout Great Britain, the results being tabulated below :—

LYING-IN HOSPITALS OF GREAT BRITAIN.

Authority.	Hospital.	Method.	No. of Cases.	No. of Cases of O.N.	Percentage.
The Matron - -	British Lying-in - - -	HgCl 1–2000; wash out daily for 3 days, 1–4000.	5,482	5	·09
G. Hastings Tweedy, Rotunda Hospital Reports.	Rotunda Hospital, Dublin -	4 gr. $AgNo_3$, wash out - -	12,575 (1900-1906).	33	·02 In 1885–1887, it was ·99 per cent.
L. E. Faulkner - -	Birmingham Lying-in Charity	HgCl, 1 per cent. $AgNo_3$ -	1,361	1	·07
J. C. Henderson - -	Glasgow Maternity Hospital -	$AgNo_3$ 1 per cent., protargol 20 per cent.	—	—	1·00
H. G. Garstshow -	City Lying-in Hospital, 1902–1906.	HgCl 1–2000; $AgNo_3$ 5 grs. -	2,983	4	·16
St. A. Coles - -	General Lying-in, York Road, 1887–1906.	HgCl 1–3000 - - -	10,369	41	·39
S. Stephenson - -	Queen Charlotte Lying-in Hospital.	$AgNo_3$ gr. v. - - -	6,603	144 (26 severe).	1·6

The disproportion in the number of cases in various institutions is probably partly accounted for by the difference in the class of patient attended, and it is also probable that a certain number of mild forms of ophthalmia neonatorum is not taken into account in some of the statistics, whilst, in other statistics, cases are included, in which the discharge is due to the action of chemicals, and not of a pathogenic organism. Thus at Queen Charlotte's Hospital, in 6,603 cases, there were 144 cases of ophthalmia neonatorum; of these only 26 were severe. The reports of the Rotunda Hospital show a decrease in ophthalmia neonatorum. Thus, in the years 1885 to 1887, the percentage was ·99, whilst, from 1904–1906, it was ·009, which is probably due to the better carrying out of the prophylactic treatment.

Thus it is seen that, in the lying-in institutions of this country, that is to say, where proper prophylactic precautions are carried out, the percentage can be reduced as low as ·009 per cent. (Rotunda Hospital) of the total number of births in the class of patient which is most liable to the disease.

Sex.—The disease, according to most authorities, occurs equally in both sexes, although, in the Moorfields cases collected by me, there is a slight preponderance in females. In 269 cases there were 125 males to 138 females, *i.e.*, 46·04 per cent. males to 51·30 per cent. females. In the Central London Ophthalmic Hospital, they are equal, 24 males and females in 48 cases of ophthalmia neonatorum.

Summary.—To summarise the whole sociological question. As shown by the returns of the Census and the Blind Schools, there was a more or less sudden decrease in the number of cases of ophthalmia neonatorum after the introduction of prophylactic treatment, and since that time a gradual decrease has been going on; but the disease is still prevalent to a very unnecessarily large extent, dooming thousands of children yearly to complete blindness for life as the result of a disease which is almost, if not entirely, capable of being eradicated by the proper treatment of infants at birth, and which, as will be shown later, can always be cured without damage to vision, if treated sufficiently early. Looking at it purely from the financial point of view it is, at the present time

costing the community some £350,000 a year to educate and look after these children, which sum might be saved by the necessary legislation, insisting on the use of a prescribed prophylactic treatment, and the notification of the disease, if it occurred in spite of it. Short of this, proper instruction, both to midwives and to medical students during their training, ought to be more fully carried out.

The objections that can be raised to the prophylactic treatment are :—(1) the sentimental or moral objection; (2) the injury supposed to be produced by the application of the silver. The former of these would cease to exist, if prophylactic treatment became universal, especially as, by no means, all cases are due to the gonococcus; the second will be discussed more fully when considering treatment.

(*To be continued.*)

MEMBRANOUS RHINITIS.

By FRANK A. ROSE, M.B., F.R.C.S.,

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MEMBRANOUS, or fibrinous, rhinitis is a disease, which has been recognised for twenty years, and, during that time, many papers have been written upon it, in which the symptoms, and the course of the disease, have been described in detail and its pathology discussed; nevertheless, the condition is frequently overlooked, even by those, who devote special attention to diseases of the nose and throat, and many medical men are content to ignore it entirely.

Yet it is by no means of rare occurrence, and nearly all, who have interested themselves in the disease, believe it to be common. Lack[1] observed his 36 cases in 15 months. I have notes on 8 cases, which occurred in a nose and throat department in the course of one year.

In any children's hospital, or hospital, with a large out-patient department, opportunities for observing the disease must be frequent, and, with the aid of a bacteriological examination, it is not difficult to recognise the condition.

Age.—The patient is nearly always a child, commonly between 3 and 8 years of age, and probably, in 90 per cent. of cases, the age is less than 10. Older people are occasionally attacked, but, after the age of 20, the disease becomes decidedly uncommon, although I have seen it in a woman, aged 26 years.

General Condition.—The general health of the patient undergoes remarkably little disturbance. The temperature rises to 99·6° F. or 100° F., it seldom rises higher than that, and frequently not so high. There is some pallor, a slight degree of lassitude, and loss of appetite. But the child runs about as usual, or plays with its toys, and the mother seldom thinks it necessary to keep it from school.

Nasal Discharge.—The first symptom to attract attention, as a rule, is the running from the nose. At first, the fluid is clear and watery, but so irritating that the alæ nasi and upper lip become reddened and sore. Later, the discharge becomes

thicker and more purulent, and occasionally pieces of shreddy material are expelled from the nose. It does not become offensive.

Bleeding.—Bleeding is very common, but the amount of blood lost is trivial. Sometimes the hæmorrhage is spontaneous, and the discharge becomes blood-stained from time to time. At others, it is excited by slight injuries, such as picking the nose, or attempts to clear the nasal fossæ.

Nasal Obstruction.—After 4 or 5 days, if not earlier, the nose becomes completely obstructed, and the child is then forced to breathe through its mouth, and snores at night. It is usually, on account of the difficulty in breathing, or because of the bleeding, that medical advice is sought.

Nose.—When the discharge has been wiped away, and the nose inspected, the mucous membrane, if visible, is seen to be congested, and covered by a thin white film, which cannot be readily wiped away. In other cases, the nasal fossæ are filled with a gelatinous yellowish white membrane, somewhat tough in consistence, yet easily torn when gripped with forceps. At a later stage, one may find no membrane, but only blood and muco-purulent material. In any case, it is only possible to see a short distance into the nose. In about 20 per cent. of cases, the disease is unilateral, and only one nostril is attacked.

Pharynx.—In the pharynx, as a rule, nothing abnormal is visible, and the disease is restricted to the nose, yet occasionally a small patch of exudate may be seen.

Course and Complications.—The persistence of the condition, whether treated or not, is an important feature.

From four to six weeks is a common period, but it may be two or even three months before the symptoms cease. During this period, the disease runs an exceedingly mild course. Paralysis is conspicuously absent, and the only complication likely to occur with any frequency is otitis media. It should be borne in mind that the discharge from the ear, in such cases, contains diphtheria bacilli.

Bacteriological Examination.—A culture taken from the membrane, or nasal discharge, yields diphtheria bacilli in large numbers. The usual pathological report is, "Diphtheria bacilli in almost pure culture."

In the later stages, cocci of various kinds are found in

addition, which probably merely represent a secondary infection.

Diagnosis.—The bilateral form has to be distinguished from ordinary nasal catarrh, for which it is so frequently mistaken. The stuffiness of the nose and the discharge are features common to both, but there the resemblance ceases. In membranous rhinitis, the long duration of the symptoms, without improvement, and the history of bleeding from the nose, should excite suspicion. Inspection of the nose reveals fibrinous exudate covering the mucous membrane, or the tough yet gelatinous membrane filling the nasal fossæ,—a condition quite different from that found in acute catarrhal rhinitis. Finally, the finding of an almost pure culture of true diphtheria bacilli will set the matter at rest.

The unilateral variety of the disease must be distinguished from a foreign body in the nose.

The symptoms of the two conditions are very similar.

In both, there is a watery or muco-purulent discharge from one nostril: in both, the nasal fossa is obstructed on that side; in both, bleeding is apt to occur spontaneously, or on slight provocation; in both, the patient is usually a child between 3 and 8 years of age.

But when a foreign body is the cause, the discharge has an offensive odour, and inspection of the nose, or investigation with a probe, commonly reveals the boot button, which has been secreted. If necessary, this examination should be made under an anæsthetic.

Further, a culture shows, in the case of membranous rhinitis, the typical diphtheria bacilli, whilst, in the case of a foreign body, it is usual to find a mixture of cocci belonging to different groups.

Treatment.—The diagnosis having been confirmed by bacteriological examination, the most important point in treatment is isolation. The patient is a dispenser of virulent diphtheria bacilli, and must be kept apart from his fellows.

In addition to this, diphtheria anti-toxin should be injected, and the nose should be irrigated with a dilute antiseptic, such as boric acid gr. v. to the ounce. These measures are desirable, in view of the nature and situation of the disease, but it has

not become evident, up to the present, that they materially shorten its course.

Pulling away the membrane is useless as a method of treatment, for more membrane is certain to form.

Bacteriology.—It is clear from the foregoing that the disease derives its interest and importance, not from the danger to the patient, that in most cases is trivial, but from the presence of the diphtheria bacillus in a virulent condition.

The older writers on the subject were not aware of this fact. Major,[2] describing a case, in 1886, evidently did not suspect it. Gluck,[3] writing in 1889, makes no mention of any bacteriological examination.

But when it became the practice to take cultures from the nasal discharge, the relationship between membranous rhinitis and the Klebs-Löffler bacillus was firmly established.

Park,[4] in 1892, described 6 cases, in all of which he found diphtheria bacilli. Other observers confirmed this. In 1899, Lack examined 33 consecutive cases, and found the Klebs-Löffler bacillus in every one. In 15 of these, the culture was pure, and, in 18, cocci were also found.

Results such as these, and my own observations merely serve to confirm them, rendered it impossible to doubt that this bacillus was constantly present.

But it is well known that the diphtheria bacillus is only one member of a group of bacilli, the members of which bear considerable resemblance to one another.

Examples of these are Hofmann's bacillus, the bacillus of xerosis, Cautley's bacillus, bacillus coryzæ segmentosus, the bacillus septus, described by Benham,[5] in cases of "common cold." They are all included under the title "diphtheroid bacilli."

Some of these have been found, with great frequency, in the nose and pharynx, and their presence has, on many occasions, led to mistakes in the bacteriological diagnosis of diphtheria.

It was most important, therefore, to ascertain as fully as possible, that the bacillus, found in membranous rhinitis, was the true diphtheria bacillus, and not one of these diphtheroids.

Fortunately, the evidence on this point is very strong, and all goes to prove that the bacillus of membranous rhinitis and that of diphtheria are identical. In the first place, the metachromatic granules are readily observed, when stained by

Neisser's method, or any of its modifications, so that, under the microscope, no difference can be observed.

The cultural characters, on solid media, are the same as those of typical diphtheria bacilli, although there is frequently difficulty in keeping the culture alive, and the tendency of the bacillus to die out may make it almost impossible to obtain a pure culture.

Gordon has shown the "sugar reactions" to be a valuable method of separating closely allied bacteria. I have only been able to apply this test on three occasions, but, on each, the bacillus, from a case of membranous rhinitis, gave reactions identical with those given by typical diphtheria bacilli.

Virulence and Toxin Formation.—Lack's observations on this point are conclusive. Bacilli, obtained from 23 different cases of membranous rhinitis, were injected into guinea-pigs. All the guinea-pigs died within 4 days, and the usual lesions were found post-mortem. He showed further that the bacilli were capable of producing toxin, and that this toxin could be neutralised by diphtheria anti-toxin.

In all respects, therefore, the bacillus, which is constantly present in membranous rhinitis, is identical with that found in faucial diphtheria. Every test, which pathologists have as yet devised, has been applied, and the result has always been to confirm the observations of those, who first asserted that the Klebs-Löffler bacillus was the cause of membranous rhinitis.

But a difficulty still remains. Granting, as we must do, that the disease is due to the diphtheria bacillus in an active condition, and capable of producing toxin, how is it that the patient is hardly ill? How is it that no paralysis follows? It is difficult to give a satisfactory answer to these questions. The most probable solution is that sufficient toxin is not absorbed to produce the symptoms characteristic of severe faucial diphtheria.

It is known that adults and children frequently get sore throats, due to diphtheria bacilli, and yet their constitutional disturbance is trivial, and sequelæ are absent. Nevertheless, such persons are capable of conveying infection to others, in some of whom the disease may assume a severe form.

Dr. C. J. Thomas,[6] when speaking of the spread of diphtheria in schools, says: "Children, presenting *slight clinical*

symptoms, are overwhelmingly preponderant amongst those spreading the disease in school."

Diphtheritic whitlow affords another example of a disease, which is undoubtedly due to virulent diphtheria bacilli, and yet is not characterised by much constitutional disturbance, and is not followed by paralysis. We cannot think that patients, with this complaint, do not absorb *any* toxin, and are, therefore, forced to believe that the dose is not sufficient to cause paralysis.

It follows that absence of prostration, and absence of paralysis, cannot be used as valid arguments against the disease being diphtheria.

I see no escape from the conclusion that membranous rhinitis is a mild form of diphtheria, and should be treated as such. At the same time, it is an interesting clinical fact, that, if a susceptible person is exposed to infection from this disease, he is most likely to develop membranous rhinitis, or else a sore throat, with a small patch of exudation, and it is not probable that he will be the subject of severe diphtheria.

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[3] Gluck: *Medical Record*, 1889, XXXV., p. 461.

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NOTES FROM FOREIGN JOURNALS.

A NEW DEPILATORY PASTE.

After repeated experiments, Bilouet of the French Army has obtained an efficient substitute for the use of the razor in the removal of hairs from any part of the body, before operation. He publishes the formula, in the *Archives de medécine militaire*, and states that it has yielded excellent results, particularly in several cases of radical cure of hernia.

Mono-sulphide of sodium - - -	1 part,
Quick-lime - - - -	1 part,
Starch-powder - - - -	2 parts,

and sufficient water to make a paste.

The lime and the mono-sulphide of soda must be finely powdered in separate mortars. The mono-sulphide is then well mixed with the starch, and with this, the lime is carefully mixed up. Water is then added in just sufficient quantity to form a soft paste, neither a fluid, which is inert and useless, nor a grumous powder, which cannot be applied. The area, which is to form the field of operation, is well washed with soap and a brush in plenty of hot water, and all the longer hairs are clipped with scissors. The paste, freshly made, is then applied with a bone spatula over the area to a thickness of rather less than one-tenth of an inch. After waiting for five minutes, and making sure that all the hairs are detached, the layer of paste is easily removed with a sterile swab and a small jet of boiled water. The surface is left completely denuded of hairs, and particular care must be taken to avoid leaving any of the paste behind, as it will set up a secondary caustic action. The area is then kept covered with a sterilized dressing until the operation begins.

"DARTRES VOLANTES" OF THE FACE ADN THEIR TREATMENT.

Under this name, Sabouraud discusses, in *La Clinique*, certain squamous affections of the face, which chiefly occur as pityriasis simplex of the moustache and beard.

The scurf is usually dry, easily shed, and powders the clothing, but it may be more fatty and less powdery, a condition which is frequently found in the moustache. Fatty or dry, they are obstinate to treatment and very frequently recur, and, for this reason, Sabouraud advises against the use of active treatment by means of coal-tar, or sulphur, ointment. A milder method, kept up for some length of time, will in the end effect the removal of the cause, instead of merely tinkering with the symptom. Spirituous lotions faintly iodised, and tarry lotions are best to use. There are several forms of saponified coal tar, and of tar made easy of solution. The patient should be advised to add one teaspoonful per litre of *Coaltar saponiné*, or, better still, some preparation of oil of cade, to the water used for washing the face. This is, as a rule, quite enough to keep a beard in good condition, but the disease is not quite so tractable in the moustache, for which the patient should, in addition to the above, apply, each morning, a swab of absorbent wool moistened in Eau de Cologne

containing one minim of tincture of iodine in $3\frac{1}{2}$ ounces. The same pityriasis, with fatty scales upon a red base, often called "Eczema seborrhoica of Unna," is to be found upon the face, or on the forehead close to the scalp. For this, ointments are necessary, such as

℞. Sulphur. præcip.
Resorcini - - - - - āā gr. xv.
Ol. Cadini.
Liq. Carbonis - - - - āā ʒijs.
Ol. Betulii - - - - ℥xx.
Paraffini mollis.
Adipis lanæ - - - āā ʒiij.
Misce. Fiat unguentum.

"To be rubbed thoroughly in every night, and washed off with soap in the morning."

A second form of the lesion is seen in children, arising from impetigo contagiosa. As it is more inclined to recur than to be obstinate, treatment is easy. It soon disappears under the influence of the following:—

℞. Tannin. in Aether. - - - - - ℥xx.
Calomel. - - - - - - gr. xv.
Paraffini mollis. - - - - - ʒj.
Misce. Fiat unguentum.

In order to prevent superficial inoculations in this class of cases, the water, used for washing the face, should contain one tablespoonful of the following:—

℞. Zinci Sulphatis - - - - - ʒjjs.
Cupri Sulphatis - - - - - gr. xl.
Aq. Camphoræ - - - - - ʒx.
Misce. Fiat lotio.

A condition of the face, in which the skin is dark and powdery, is often seen in children and young women, and is caused by the over-use of soap. This should be stopped, and the following applied:—

℞. Zinci oxidi - - - - - ʒi.
Paraffini mollis.
Adipis lanæ.
Aq. Rosae - - - - - āā ʒiij.
Misce. Fiat unguentum.

TUCKER'S ASTHMA-CURE.

Several analyses of this much-used patent medicine have been published, the latest, by Einhorn, appears in the *Münchener medizinische Wochenschrift*, giving the following percentage composition:—

Cocaine Nitrite	1·028
Atropine Nitrite	0·581
Glycerine	32·16
Water	66·23

TREATMENT OF ACUTE CATARRH OF THE UPPER AIR-PASSAGES.

Seiffert recommends for general treatment, confinement to bed, or at any rate to the room; avoidance of alcohol, especially beer, although a light red wine may be allowed in some cases; stoppage of tobacco,

of the use of salted foods, and of hot foods.

In the acute rhinitis of infants, he gives an insufflation, two or three times a day, of a powder consisting of:—

℞. Acid. Boric - - - - - - ʒiij.
Bismuth. Subnit. - - - - - ʒv.
Misce. Fiat pulvis.

Later, an addition is made to this of ʒss. of menthol. A few drops of a 5 per cent. solution of cocaine and alypine may be introduced into the nostrils. An useful addition is to sprinkle the pillow several times a day with 10 to 15 drops of Hager's mixture:—

℞. Acid. Carbolic.
Lig. Ammoniæ - - - - āā ʒij.
Sp. Vini Rect. - - - - - ℥iss.
Aq. - - - - - - - ʒiv.
Misce. Fiat lotio.

Older children should inhale camphor-vapour from a glassful of hot water, on which is sprinkled a pinch of powdered camphor. The steam should be inhaled through the nose by the help of a paper tube, and should be carried out for five minutes at a time thrice daily. Formaldehyde is also useful, but of special value is the use, three times a day in a throat-spray, or drop-bottle, of ♏xx. of:—

℞. Phenazoni. - - - - - gr. xxx.
Cocain. Hydrochlor. - - - - gr. xv.
Aq. destill. - - - - - ʒiij.
Misce.

In acute pharyngitis, a cold compress, or hot fomentation to the throat as the patient prefers, is to be recommended. Gargles are not of much use, except those of hot normal saline. When there is intense inflammation, with great pain, the throat should be sprayed three times a day with a 1 per cent. solution of cocaine and alypine in water.

In acute inflammation of the larynx and trachea, the patient must be forbidden to speak. Menthol vapour is of much value: 15 drops of a 10 per cent. solution in olive oil should be used in a steam-inhaler. (*Deutsch. med. Wochenschr.*)

THE DOSE OF STRYCHNINE.

Professor Troisfontaines considers that strychnine ought to be given in much larger doses than is customary. Better therapeutic results would then be obtained than at present. Treating himself for overwork, the professor took, in three doses at meals, 15 m.g. (= ·23 of grain) for three weeks, 24 m.g. (= ·31 gr.) for nineteen days, and 15 m.g. for a fortnight, taking in all 5·55 grammes. At the same time, he cured an acute œdema of the lungs, in a gouty subject, by giving 20 m.g. (= ·30 gr.) of sulphate of strychnine in one hypodermic injection, and continuing to give fractional doses every hour until the crisis of the attack was passed. To an infant one month old, suffering from serious bronchitis, the daily hypodermic dose given was 2 m.g. (= ·03 gr.) of sulphate of strychnine. This treatment was continued for six days, and the patient made a good recovery. The general condition of two patients, well advanced in years, one being 82, and the other 87 years of age, was greatly improved by a daily dose of 9 to 24 m.g. (·14 gr.) of strychnine. (*Gazette méd. Belge.*)

Notes by the Way.

The New Year.

We need not look for fresh reasons for wishing our readers a happy and prosperous New Year, or for novel phrases in which to express our wishes. There is a sense, of course, in which a good year for the medical profession means a bad year for the community at large; and cynical laymen are a little apt to picture doctors desiring epidemics in the spirit of the soldiers who used to drink to "a bloody war and quick promotion." It is superfluous to say that our hopes for 1908 do not run upon those lines—that our desire is, above all things, that the next twelve months may be twelve months of a steady progress in medical knowledge. Many difficult and important professional problems seem near to solution at the present time. May some of them be solved and others advanced a stage before the year has run its course! Those are our aspirations, to which we may add our promise to help towards their fulfilment by continuing to present our readers with the results of the latest researches in a lucid and convenient form.

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Winter Holidays.

The season suggests not only sanguine anticipations of the work to be done in the course of the year now beginning, but also reflections upon the virtue and value of winter holidays. One of the most pleasant signs of our civilisation is that, as time progresses, holidays become more frequent, and the opportunities of making a healthy use of them are extended. The jovial Christmas upon which Dickens dilates with gusto was mainly a festival of gluttony. The fatness of the fat boy in "Pickwick" is largely accounted for by the record of the orgies at Dingley Dell. It is not to be pretended, of course, that the tradition which associates such excesses with the season is even now extinct. But we have, at any rate, a larger choice than our forefathers had of alternative and more profitable recreations. The opening up, in winter, of the high Alpine resorts, with their snow sports and ice sports, has been almost

entirely effected in the course of the last half-dozen years or so. Skating, ski-ing, curling, tobogganing, and bob-sleighing have been brought, not, indeed, within the reach of everyone, but within the reach of all who can afford themselves ten days' or a fortnight's leisure. Until quite recently it was only at Saint Moritz and Davos that the hotels were open in winter; and such hotels as were open received few visitors except invalids, who had a long, cold, and painful journey in order to get to them. Nowadays all this is changed. Not only have the new mountain railways made the resorts specified easily accessible; plenty of others much nearer at hand have been exploited. The nearest of them is at Le Pont, in the Jura, at the very gate of Switzerland. There are others, only a little further on, at Grindelwald, at Adelboden, at Chateau d'Oex, at Corbeyrier-sur-Aigle, at Villars-sur-Ollon. Almost all of them can be reached in about eighteen hours from London. The snow is certain to fall, and the sun is almost certain to shine at any one of them. A short stay in them, and a brisk participation in their amusements, has a bracing and invigorating effect, which no one fully realises who has not tried the experiment.

* * * * *

Mountain Sickness.

AN event naturally suggested by any mention of mountains is Dr. T. G. Longstaff's recent ascent of Trisul, in the Himalayas (23,406 feet). It is the highest of all undisputed ascents, though we are inclined to believe that Mr. W. W. Graham did, as he claimed, get a few feet higher on Kabru in the eighties. The achievement, at any rate, shows that mountain sickness is one of the complaints with which we are gradually learning to grapple. When climbing began, the distressing symptoms invariably appeared at much lower elevations. In the works of Sir John Mandeville we read of mountain sickness on Mount Athos, which is only 6,350 feet high. "And men seye in theise Contrees," he writes, "that Philosophres som tyme wente upon theise hilles, and helden to their Nose a Spounge moysted with Watre, for to have Eyr; for the Eyr above was so dry." Borelli, again, was afflicted on Etna in 1671; and Bourrit, the self-styled Historiographer of the Alps, says that it was owing to the prevalence of

mountain sickness that the pilgrimage to the shrine at the top of Roche Melon had to be abandoned. He himself frequently suffered from the malady on the Buet; and so did Acosta, and Humboldt, and the Academicians in the Andes, while the early climbers of Mont Blanc were in almost every case seriously troubled. Nowadays a good man can generally attain a much greater altitude without experiencing discomfort, probably because he is, as a rule, in better training, and better equipped for his expedition. We are hardly entitled to infer from Dr. Longstaff's success that the foot of man will some day tread the summit of Mount Everest. Mount Everest is nearly 6,000 feet higher than Trisul, and the final stage may very well prove to be the hardest. Still we are entitled to take a hopeful view of the case; and that is the view which, as, a matter of fact, the majority of climbers take.

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The Brown Dog.

THE "brown dog" incident at Battersea has brought a great deal of unmerited opprobrium upon the heads of the vivisectionists. It is certainly a principle of the law of England that, except in specified circumstances in which "reasonable force" may be used, no man is entitled to take the law into his own hands; but it does not follow that sympathy must always be refused to those who do so. In the case of the attack on the monument of the "brown terrier dog done to death in the laboratories of University College," etc., the letter of the law was no doubt on the side of the monument. The "rags," however, remind us of a certain saying of Mr. Balfour's at the time when riots were apt to occur at pro-Boer meetings. There were, he said, "limits to the endurance of human nature," and, when these were strained too severely, excuses for riotous behaviour could be admitted. In the instance under our notice a breach of the peace was committed because a breach of the peace was provoked. We need say no more than that. It is another matter, however, when we come to the impeachment in the lay papers of the vivisectionists. Then we can meet assertion with fact, and point out some of the positive gains which medicine and surgery have achieved as the result of this method of research.

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Vivisection. Sir Victor Horsley some years ago showed that a complete removal of the thyroid gland was followed, in monkeys, by the presentation of a condition similar to myxœdema. By engrafting a piece of thyroid gland into the body, he caused the symptoms to disappear, and thus paved the way for the treatment of myxœdema by thyroid extract. Brilliant vivisectional work, too, by Ferrier, Yeo, Beevor, Schafer, Sherrington, and Grünbaum, in connection with cerebral localisation, has enabled the physician to diagnose the position of tumours on the cerebral cortex, with the result that the surgeon can now operate successfully for their removal. The discovery of the microbes responsible for bubonic plague, Malta fever, tuberculosis, malaria, diphtheria, and a host of other maladies, are other triumphs of research effected by means of vivisection, and are the direct outcome of experimental work done during the last forty years. It may be—we are not concerned to deny—that the discoveries have cost the deaths of, and, in some cases, the infliction of slight pain upon, some of the lower animals; but a vast number of human beings have been saved from death. The practice of vivisection, in short, is, as Sir J. Fletcher Moulton said in his evidence before the Royal Commission, "the only bit of fruitful pain in the world."

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Medical Officers of Health. A good deal of feeling has been aroused—and some occasion for comment has been furnished—by the recent action of certain local authorities in revising the conditions on which their Medical Officers of Health hold their offices. Their action, and the acrimonious talk resulting from it, are very regrettable for several reasons. The squabbles will certainly not tend to improve the status of the medical profession generally, and of this important branch of it in particular, in the eyes of the man in the street; nor, on the other hand, are they calculated to attract the best men to a service in which good men are eminently needed. What is to be done?

* * * * *

The need of Legislation. Certainly it is ridiculous to expect that men of education, intelligence, and scientific training should be absolutely under the control and at the mercy of popularly elected local bodies, directed

and manipulated, as we so often find in practice that they are, by uneducated men, grossly ignorant of the laws of hygiene, and with various axes of their own to grind. It may often happen that the medical officer of health, in the impartial discharge of his duties, finds himself compelled to take a line at variance with the interests of some local councillor; and it is unreasonable, and also prejudicial to the public interest, that he should only be able to do this at the risk of his position and emoluments. On the other hand, it scarcely seems just to demand that he should be an irremovable official. That would be to give him an undue advantage from which the public interest might, in conceivable cases, suffer. We feel, however, that he should at least have reasonable security of tenure; and our suggestion is that he should be given a right of appeal to the Local Government Board, and that the express sanction of that department should be necessary not only for his dismissal but for any reduction of his salary or modification of his duties which would be tantamount to dismissal. Furthermore, it ought, we think, to be required that a full statement of the reasons for the proposed changes should be furnished, not only to the Board, but also to the Medical Officer of Health, so that he might have every opportunity of stating his own case and making his own representations. The Board would, of course, consider the interests, not of any individual, but of the town; and so justice would be done. The question is assuredly one which calls for early legislative treatment; and we have reason to hope, from statements made by the Parliamentary Secretary to the Local Government Board, that the matter will shortly be taken into careful consideration.

THE PRACTITIONER.

FEBRUARY, 1908.

A CLINICAL LECTURE ON THE CAUSES AND OPERATIVE TREATMENT OF UMBILICAL AND VENTRAL HERNIA.

By ARTHUR E. BARKER, F.R.C.S.,

Professor of Surgery at University College Hospital Medical School, and Surgeon to the Hospital; Consulting Surgeon to the Queen Alexandra Military Hospital, Millbank.

A GREAT deal of progress has been made, within the last few years, in the treatment of these two varieties of hernia by operation. The cause of this is, to a great extent, to be found in the larger number of ventral herniæ met with nowadays, owing to the vast expansion of abdominal surgery. With this greater frequency of ventral herniæ has grown, as a matter of course, the study of those means which may be adopted for their prevention and repair, and what has been learned, in this direction, has been found of equal value in dealing with umbilical herniæ. We may be asked, perhaps, why abdominal operations should be followed by ventral herniæ at all. The answer to this is that, quite apart from defective methods adopted for the closure of abdominal wounds, and from occasional unavoidable suppuration, as in operations on suppurating foci, where drainage was required, or, avoidable, where sound tissues alone are cut through, there is the fact that scar tissue, even of aseptic wounds, has rarely the strength of the tissue it is designed to replace. Moreover, the plastic processes, concerned in the repair of an abdominal incision, take place under conditions of unrest and irregular strain from respiration, vomiting, etc., not present in many other parts of the body. Of this we are constantly reminded by the fact that the umbilicus, although, so to speak, a necessary physiological scar, remains an admittedly weak spot throughout life, and that, in infants, subject to fits of coughing or crying, to vomiting, or straining at stool or during micturition, umbilical hernia is frequent.

The causes of umbilical herniæ are therefore obvious, in the presence of a scar of greater or less density, at a spot on which there are strains in three directions, vertically by the two recti, laterally by the forces compressing the contents of the abdomen, and at the same time from within outwards by the same. In the normal infant, with well-developed abdominal muscles, and unaffected by abnormal strains during the process of healing of the umbilical stump, the scar of the latter is small in size and strong, with every chance of becoming stronger. But in those with ill-developed muscles, and subject to straining from crying, coughing, etc., this scar yields, and hernia results. Although this may not occur during early life, it is prone to take place from the same causes later on, when fat accumulates, and the general muscular tone of the body is falling off. Once begun, a protrusion exercises a distending force in all directions.

This is also the general scheme of the formation of a ventral hernia, after injury, surgical or other, in whatever part of the abdominal wall it occurs.

It is quite plain, then, that whether we have to deal with an umbilical or a ventral hernia which we wish to radically cure, we cannot always rely upon a simple drawing together of the mere edges of the ring after replacing the contents. These edges consist of scar tissue, and will be united by scar tissue as thin as they are themselves, and no more capable of retaining the abdominal contents than the original cicatrix. Besides this, there is a factor in each of these forms of hernia common to both, if they are of unusual size, which militates strongly against their permanent cure. This is the bulk of the viscera, which has to be reduced. If this is large, the strain within the abdomen is increased by the return of the contents of the sac into the abdomen, and this strain is the worst thing for the new young scar tissue as it was for the old. Not only is this so, but, when a large bulk of viscera is returned within the abdominal cavity, there is a serious risk of the internal pressure interfering with the movements of the diaphragm, and of the patient's respiration being seriously interfered with immediately after the operation. For this reason, it is a good rule, wherever masses of omentum are found, either in a ventral or umbilical hernia, to remove them, either wholly or in part, rather than to reduce them. Again, in the case of inordi-

nately large hernia, if the patient is short of breath, from one cause or another, it is of doubtful expediency to undertake any operation at all.

Of course, ventral herniæ occur quite independently of any surgical operation, *i.e.*, from injury either direct or indirect, *i.e.*, from stabs or cuts, or from subcutaneous rupture of muscles the result of strain. But the forces acting on the consequent scar tissue are the same in all cases.

It will only be necessary, then, to describe the mode of dealing with a large hernia of the abdominal wall, whether it is ventral or umbilical. In all, we are apt to find a large quantity of omentum, whether they contain gut or not. In view of this fact, we must be prepared to find extensive adhesions, most frequent between omentum and sac, but often involving the bowel. This is hard to determine, in many cases, before the operation, but should be prepared for in all. Taking this into account, and also the fact that the separation of adhesions is very tedious, and productive of much bleeding, as a rule, and also that the reduction of omentum into the abdomen is undesirable, especially if it has been much handled, and is oozing, it is a good practice so to plan an operation that we can remove it *en bloc with the sac* and overlying skin to which it is attached. The incision through the skin should be so planned that only enough is left to cover in the wound; all the rest is removed with the sac. The latter is opened at the point least likely to have formed adhesions. This is usually near the neck on its upper aspect. The opening, in the first instance, should be made only large enough to examine for adhesions, and to draw an extra quantity of omentum out of the abdomen. When this has been done, the omentum is tied off in strands, divided beyond the ligatures, and the stump reduced into the abdomen. When this has left the ring free, and any gut has been replaced likewise, the sac and skin are divided all round nearly flush with the skin level of the abdominal wall, and taken away with all the omentum still adherent to them, and the ring is left quite clear, packed of course with a roll of sterile gauze to protect the parts within.

The next step consists of closing the edge of the ring, which is still clothed with the reflected edges of the sac. These need not be dissected off, but are simply included in the stitches passed through the edges from within, half an inch from the

margin of the opening and from one another. All are so placed before any is tied. When knotted, they include the expanded *linea alba* and the cut edges of the sac, which will tend to strengthen the first line of suture (Fig. 1).

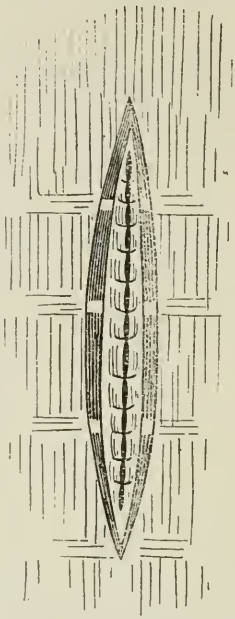

Fig. 1.—*First stage of closure after cutting away the sac (the skin is not shown). The edges of the neck of the sac have been brought together, and the rectus sheath has been opened on both sides showing the muscle.*

The next step depends upon whether we are dealing with unusually large openings in weak-walled abdomens, usually associated with great obesity, or have only to close a moderate-sized deficiency, in a fairly muscular individual with thick muscle sheaths. If the former, as might be expected, and as experience proves, most ordinary suturing will not give a permanent cure, and we shall do well to reinforce the muscular and aponeurotic structures with some insoluble network, which will become incorporated with the abdominal wall, and resist all impulses from within. The best of these is a wire filigree of one form or another. This, which has been advocated by many surgeons, among whom may be mentioned Bartlett in America, Witzel in Germany, and, in this country, more recently, by Mr. L. McGavin, has proved very satisfactory.

Previous to the use of these ready made wire networks, many surgeons, including myself, were in the habit of closing the ring with buried silver wire sutures. My own practice was, in addition to this, to interlace the ends of these sutures, purposely left long, over a considerable area round the closed ring. This answered well in the 20 or 30 cases, in which I employed it, and retained the hernia certainly for years in many cases; all could not be followed up, but I have not heard of a recurrence among these patients, though many of the herniæ operated on were very large, and in thin-walled abdomens. But this method of interlacement of wire during operation was tedious and complicated, and the use of ready made silver networks is undoubtedly a great advance upon it. I have used these now in a considerable number of cases with great saving of time, and, so far, with at least as good results as before.

But, in the smaller umbilical and ventral herniæ, especially where the walls are fairly developed, these contrivances are not specially required, and we may be content with simpler measures. The method, which I have always found best, is based upon the idea that no bond of union here will resist the strain from within, unless it is *broad*. But, in this case, such a broad line of adhesion cannot be obtained from the aponeurotic structures round the ring, if they are simply brought edge to edge. It is necessary, therefore, to fold them over, and, by preference, inwards. I have always done this in the following manner. After the first closing of the opening, as described above (Fig. 1), a suture is entered through the anterior layer of the unopened rectus sheath, about two-thirds of an inch from the line of union of the first row of sutures, closing the edges of the ring and sac, and is brought out of the sheath close to this line of suture. The thread is then passed across, and entered into the rectus sheath, on the other side of the first line of closure, and again brought out two-thirds of an inch from the point of entry (Fig. 2). When a row of threads has been thus employed from the top to the bottom of the weak spot, half an inch from one another, it is clear that, when they are drawn together, they will fold inwards the ridge formed by the first row of sutures, and bring about half an inch of the anterior surface of the rectus

sheath on one side into contact with the same amount of sheath on the other (Fig. 3). In this way, we have two fairly solid ridges of tissue covering the ring, whether the stitches

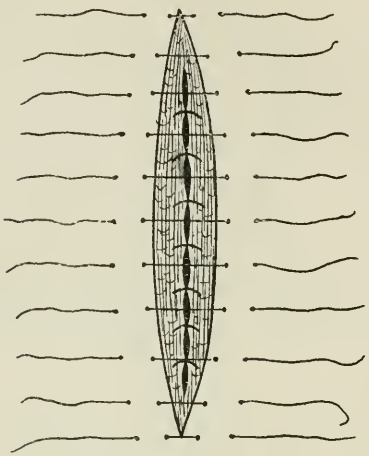

Fig. 2.—*Sac closed by first line of sutures, second row of sutures introduced through anterior layer of rectus sheath. When drawn together and knotted, the edges of the sheath are folded inwards and apposed to the extent of about* $\frac{1}{2}$*-inch, forming a solid bond of union.*

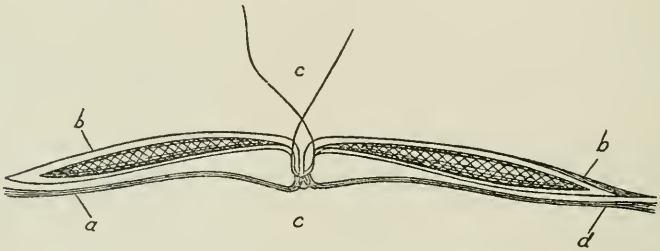

Fig. 3.—*Diagram indicating the folding of the anterior layer of the rectus sheath,* b.b. *over the line of suture of the peritoneum and transversalis fascia,* a.a. *at* c.c.

are of thread or wire. When these have consolidated, a very firm thick barrier is erected against the forces acting from within. Moreover, the recti muscles are drawn together, and give more support than formerly. Such cases have, in my experience, done particularly well. But the method is only suited to hernia, with rings of moderate dimensions, where the abdominal walls are fairly well developed.

When the ring is unusually large, the recti muscles widely separated, and the aponeurotic structures are stretched and thin, the addition of a wire network is undoubtedly of great value, and, if introduced with care and skill, will retain very large ventral or umbilical herniæ; the principles of application being alike in both cases. Up to the point of closure of the ring the procedures are the same. But after this, the anterior layer of the recti sheaths on both sides is opened longitudinally by curved incisions, starting well above the upper end of the first line of sutures closing the ring, and terminating well below it. These curved incisions should only open the innermost borders of the recti sheaths from above downwards (Figs. 1 and 4), and admit of the sheath

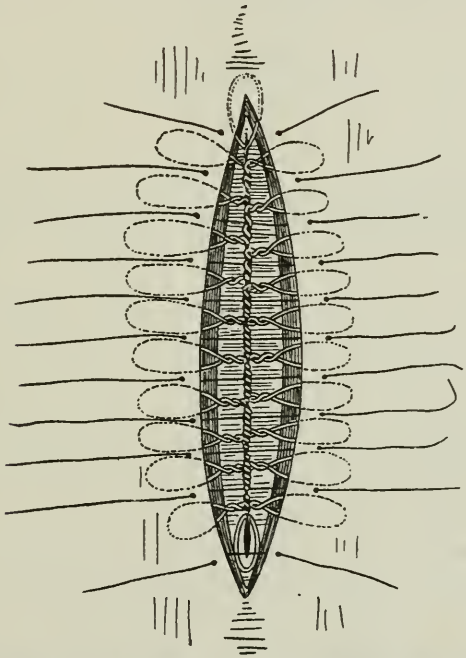

Fig. 4.—*Wire network in situ on the rectus muscle and under its anterior layer of sheath. The sutures to draw the latter together are also shown before closing the rectus sheath over the network.*

being raised from the muscle, and the latter being drawn a little towards the middle line. But the sheath must be thoroughly opened on both sides, and separated from the anterior surface of the muscle, with a blunt instrument. The

wire netting (Fig. 5), sterilised by passing through a spirit flame or by boiling, is then taken up in forceps and laid over the first line of suture, which it should well overlap

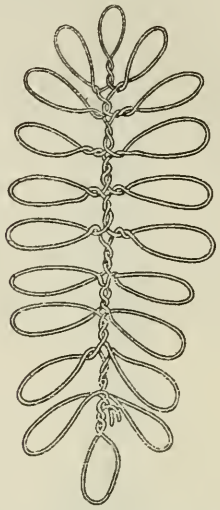

Fig. 5.—*Wire network such as I always make for myself beforehand out of one piece, beginning the first loop in the middle of the length. The wire here is a little too thick.*

above, below, and laterally. The loops, which form the border of the network, are inserted into the rectus sheath all round lying on the muscle (Fig. 4). When this has been accurately accomplished, the edges of the two rectus sheaths are drawn together over it (Fig. 4) and united in the middle line. The skin is then brought together as usual. But, as most of our patients who suffer from umbilical or ventral hernia are obese, it is well, as a rule, to leave a small gauze drain in the lower angle of the superficial wound for a couple of days. There is otherwise a certain risk of serum and broken-down fat lobules, which have been bruised during operation, accumulating subcutaneously, and interfering with repair, or inviting infection. In spare patients this is not necessary, but it should be remembered that any failure of primary union here would be particularly undesirable, not only on account of the possibility of infection of the peritoneal cavity, but also because the thorough incorporation of the silver network is of the first importance, and, if suppuration

should occur, it would not be so effectual even though it led no further. I have not seen any suppuration in these cases, but we are assured, by those who frankly admit that it has not been absent in all their cases, and has been profuse in some, that it has not ultimately prejudiced the incorporation of the network, and the cure of the hernia. Some such cases, in which suppuration had been free, were shown at the Clinical Society, and the result, some months later, was excellent. It seems as though the presence of silver in the wound was in suppurating cases rather beneficial than otherwise. For this reason we are assured that we need not yield to the temptation to remove the network, should suppuration arise, but carefully drain the wound, and trust to the tissues healing over the wire. My own cases, with one exception, in which I operated on a suppurating wound, have healed *per primam*.

In the after treatment of these cases, we must remember their great tendency to chest affections, when confined to bed after abdominal operations. This should be met by placing the patient, as nearly as possible, in the sitting position on removal to bed, and maintaining him in this position, except during sleeping hours. Moreover, the substitution of local or spinal analgesia for general anæsthesia, reduces the tendency to bronchitis and pneumonia to a large extent. Two cases, occurring comparatively recently, may be quoted to illustrate this point. Indeed it was the occurrence of complications which had led to a state of things calling for immediate operation in both cases, and under the most unfavourable conditions, as is so often the case with large umbilical and ventral herniæ, which have existed for years without giving special trouble.

The first of these examples was that of a woman, æt. 52, admitted into University College Hospital with a large umbilical hernia of long standing. This had become strangulated, during an attack of acute bronchitis, the coughing from which had forced extra coils into the sac. The patient was enormously stout, weighing over 18 stone. The bronchitis was so severe that she could not lie down. The temperature was 102·6.

To have given anyone in this condition either chloroform or ether, for a long operation, would have been extremely

perilous, and, in this particular case, owing to the great obesity, certainly unjustifiable, if another method of anæsthesia could be employed. I carefully injected the tissues with my usual solution of B. Eucaine + Adrenalin, and operated with comfort to the patient and myself. The strangulation was relieved, the sac cut away with the skin covering it, and a radical cure performed by the first method mentioned above. This patient made an uninterrupted and perfect recovery.

The second example was that of a lady, weighing also about 18 stone, to whom I was recently called down into Kent, late one night, with the request that I should bring the requisites for operating under local analgesia. I found that the patient had had for a long time a large reducible umbilical hernia, which had been particularly troublesome of late. Six months before I saw her, she had had a stroke of apoplexy, and was still partially paralysed all over the left side. A few days before I saw her the left side of the sac and skin had sloughed, and, on the preceding day, the sloughing sac had burst, giving exit to the fluid contents, which were still trickling away. Besides the great slough, the whole of the skin over the lower part of the tumour, and that of the abdomen underlying it, was eczematous and moist, and the whole was very foul.

In these circumstances, I thought it best to first wash the whole field of operation, dust it with boracic powder, and constantly foment it with boric fomentations for 36 hours. I then infiltrated the whole area of operation with the same analgesic fluid, and, after the usual pause of half an hour, during which everything was prepared for a very complicated procedure, in addition to the cleansing of the skin, the operation was begun. The first thing done was to open the sac through sound skin near the neck of the swelling on the right side. Through this opening the omentum was drawn out, tied off, and the stump reduced with the gut, which was non-adherent. Then the whole tumour was held up in tenaculum forceps and cut bodily off flush with the abdominal wall below the sloughing part. On the clean tissues left, I performed the closing operation with a wire network, as described in the second method, and drew the skin over all in the middle line, with a small drain at the lower angle. The patient was quite comfortable throughout the operation, and made a perfect

recovery, everything healing completely, after the little gauze drain had been removed a few days later. There was no trouble from the lungs, and, what was specially reassuring, the left side of the wound, *i.e.*, on the paralysed side, healed almost as well as the right. The lady was soon up and about with a soundly cured hernia, the wire network within the rectus sheath having become included in the scar tissue without a hitch.

These two cases not only serve to show what serious conditions of umbilical hernia may be dealt with, even in unfavourable circumstances, but also to what extent, and with what advantage, local analgesia may be employed. In the first case, the patient was suffering from severe bronchitis, with a high temperature, as well as a bad strangulated hernia; in the second, the sac and skin were sloughing away owing to the paralytic condition on the left half of the body. Both recovered without a bad symptom. And we can hardly imagine a case, in which infiltration of the analgesic compound would be more likely to interfere with feeble repair than the latter, and yet the whole wound healed blamelessly.

As to other ventral herniæ, lying out of the middle line, the same principles underlie their treatment as in these. Here the network, if employed, is placed either directly on the transversalis fascia and peritoneum, or between the internal and external oblique muscles. Beyond this no special directions need be laid down for their use. The networks themselves can easily be made before, or during the operation, by the surgeon, out of one long piece of fine silver wire twisted as in Fig. 5. The size, of course, will vary with the need of the case. In Fig. 5 the wire is drawn too thick.

THE MODE OF PRODUCTION OF THE PRESYSTOLIC MURMUR IN MITRAL STENOSIS.

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From the time of Laennec, a large number of observations and experiments have been made with the object of elucidating the precise physical conditions, which underlie the production of murmurs, both cardiac and vascular, and, although it would be rash to assume that the mode of origin of these adventitious sounds has been exactly determined, a great deal has been done towards the solution of the problem. The view, now generally accepted, that murmurs are primarily due to the formation of currents, or eddies, in the blood stream, was originally enunciated by Corrigan, and the subsequent investigations of Savart, which were extended and applied by Chauveau, established the theory of the fluid vein on a firm basis. Nevertheless, the theory that murmurs are due to the vibrations of a fluid vein in the heart or vessels, as the case may be, has been assailed by many writers, and notably by Geigel, who asserts that the length of the vibrations, necessary to effect the pitch of murmurs commonly heard, could not possibly be produced within the cavities of the heart. Furthermore, Davidson has advanced experimental evidence of considerable weight in support of his contention, that murmurs are due to vibrations excited in the valves of the heart by the impact of the blood stream at an oblique angle. It is possible, indeed probable, that cardiac bruits have more than one mode of origin, and an attempt will be made to show that, in mitral stenosis, the presystolic murmur differs, in the mechanism of its production, from the early and mid-diastolic murmurs. In short, it will be contended that the presystolic mitral bruit is due to vibrations excited in the large anterior flap of the valve by the impact of the blood stream, during the auricular systole.

The evidence, in support of this hypothesis, is afforded by

certain anatomical and clinical considerations, which, although they may fail to carry conviction, are well worthy of serious attention.

The auriculo-ventricular opening, from its auricular aspect, is located at the lower and fore part of the chamber, and, from its ventricular aspect, at the left and posterior portion of the base of the ventricle.

The two flaps of the valve, guarding the orifice, are disposed so that the larger segment is suspended obliquely in front and to the right of the smaller, which lies posteriorly, and to the left, in close proximity to the wall of the ventricle. The large anterior flap is situated immediately between the auricular and aortic openings, and is attached, at its base, in front, to the fibro-cartilaginous ring, which surrounds the aortic orifice, while, behind, it is inserted into the upper and fibrous portion of the inter-ventricular septum. It comes to pass, therefore, that the position of the large anterior flap of the mitral valve is more or less fixed and permanent, whereas the posterior segment is freely movable, owing to the contraction and expansion of its fibro-muscular basal attachment during the systole and diastole of the heart.

Now, under normal conditions, the current of blood from auricle to ventricle, on the left side of the heart, is approximately parallel to the long axis of the ventricular cavity, so that, should anything interfere with the falling back of the anterior flap of the mitral valve, this segment would come to lie directly in the path of the blood stream flowing from auricle to ventricle. Furthermore, interference with the normal diastolic expansion of the left and posterior portion of the auriculo-ventricular orifice, or with the falling back of the posterior segment of the valve, would lead to a similar result; since, in the first event, the narrowed opening would tend to throw the current of blood forward on to the anterior flap, and, in the second, the imperfectly relaxed segment would act as an inclined plane, which would serve to direct the blood stream to the right of its normal course, and thence on to the anterior curtain. It is not unreasonable to postulate the co-operation of these factors, in connection with the incidence and development of the conditions, which lead up to, and culminate in, the narrowing of the mitral opening. It would appear,

therefore, that the morbid changes which give rise to mitral obstruction, incidentally lead to alterations in the mechanism of the valve, whereby the large anterior segment is exposed to the impact of the blood stream flowing from auricle to ventricle. By this means the anterior flap of the valve may be, and probably is, thrown into vibration, and, provided the current is sufficiently strong, there seems to be no reason why the resultant valvular vibrations should not become audible. The flow of blood from auricle to ventricle is no doubt most rapid and forcible at the time of the auricular systole, and it is during this period, therefore, that the valvular vibrations should become audible as a presystolic murmur. The evidence furnished by anatomical considerations is thus distinctly in favour of the contention that the presystolic bruit has its origin in valvular vibrations.

Clinical investigation of the presystolic murmur, more especially in its auscultatory aspects, affords perhaps the strongest testimony in favour of a valvular mode of origin. The essential feature of the bruit is its rough vibratory crescendo quality, which serves to distinguish it from all other murmurs, with the exception of the presystolic bruit that is occasionally heard in connection with aortic incompetence. Other murmurs, whether stenotic or regurgitant, although they may be rough and rasping, or soft and blowing, lack the vibratory quality of the presystolic bruit, and possess, moreover, a "diminuendo" tendency, as they decrease in intensity from their commencement to their termination. It is hardly possible that murmurs, so dissimilar in character, could have a common mode of origin. So far as the presystolic bruit is concerned, its peculiar properties suggest, for their production, the vibration of a thin membrane, such as would be provided by the large anterior flap of the mitral valve, and, if this assumption is allowed, the "crescendo" quality, that is so distinctive a feature of the murmur, admits of an easy explanation.

Thus the increase in intensity of the valvular vibrations, on which the crescendo quality of the murmur depends, is proportional to the increase in the force and rapidity of the impingent blood stream, flowing from auricle to ventricle, that is brought about by the auricular systole. In consequence of

the interference with the passage of blood through the mitral orifice, the force of the auricular contraction is maintained right up to the commencement of the ventricular systole, so that the vibratory murmur runs up, and ends in the first sound of the heart.

Incidentally, it may be remarked that one of the factors in the production of the short sharp first sound in mitral stenosis, must be the abnormally sudden and forcible closure of the bicuspid valve, which is occasioned by the ventricular systole. The closure of the valve is effected more violently than usual, for the reason that the large anterior curtain, exposed to the impact of the inflowing blood stream, is not floated up so near to the mitral opening during the filling of the ventricle, as under normal conditions, and with the occurrence of the ventricular systole, the vibrating flap is suddenly and forcibly impelled into the position which it occupies during the closure of the valve ; hence the sudden cessation of the murmur, and the incidence of the short sharp first sound.

Another peculiarity of the presystolic mitral murmur is its changeability, more especially as regards the degree of distinctness with which it is heard at different times. This characteristic is readily explicable on the assumption that the murmur has its origin in valvular vibration, inasmuch as alterations in the tension of the anterior flap of the valve, or in the force and rapidity of the blood current impinging upon it, must affect the occurrence and intensity of the resultant vibrations.

The disappearance of the murmur is no doubt due, in some instances, to the total destruction of the anterior flap of the mitral valve, though, in the majority of cases, it is accounted for by the failure of the "vis a tergo" consequent on the establishment of tricuspid incompetence.

One of the most distinctive features, in connection with the presystolic murmur, is the very restricted area of its audibility, just above and internal to the apex beat. The explanation of the cause of this phenomenon is a puzzle, which has hitherto taxed and baffled the ingenuity of all writers on diseases of the heart, and it is the most powerful argument in favour of the valvular hypothesis of the mode of origin of the murmur, that it affords a complete and satisfactory solution of the

problem. It has already been pointed out that, in the main, the basal attachment of the anterior flap of the mitral valve is continuous with the upper and fibrous portion of the septum ventriculorum. Vibrations, excited in the anterior flap of the valve, would naturally be conducted along this structure, and the site, where the septum comes nearest to the surface, is just internal to, and above the apex beat of the heart. It is to this area that the palpability of the presystolic thrill and the audibility of the presystolic murmur are commonly restricted. The murmur may, however, in some instances, be conducted upwards and inwards along the line of the septum. It seems difficult, in the face of this explanation, to resist the conclusion that the presystolic bruit is due to vibrations excited in the anterior flap of the mitral valve during the auricular systole. In any event, it is the only hypothesis, which affords anything like a satisfactory explanation of the character and area of audibility of the presystolic mitral murmur.

The usual absence of the bruit, during the early part of the diastolic period, indicates that the current of blood through the constricted opening is seldom sufficiently rapid or forcible to throw the anterior flap of the valve into vibration, but it may well lead to the formation, beyond the site of obstruction, of a fluid vein, which would account for the early and mid-diastolic murmurs.

It does not seem unreasonable to suggest that it should be occasionally possible, as, for instance, when the heart is acting slowly, to hear two murmurs during the presystolic period, to wit, one due to the vibration of the anterior flap of the mitral valve, and the other due to the formation of a fluid vein beyond the seat of obstruction.

The mode of production of the presystolic murmur, which is occasionally heard in connection with aortic incompetence, has been explained in various ways. In view, however, of the almost exact resemblance, both as regards character and area of audibility, which this murmur bears to the presystolic mitral bruit, it is hardly reasonable to doubt that the two murmurs have a common mode of origin. It is probable, as Guitéras suggested, that, when a presystolic murmur is heard in connection with aortic incompetence, the posterior coronary segment of the valve is affected, since, in this event,

the regurgitant stream would play directly on the anterior flap of the mitral valve. As a consequence, the flap is not only prevented from falling back, but is actually forced upwards towards the mitral opening, so that it comes to lie directly in the path of the blood stream flowing from auricle to ventricle and, by this means, is thrown into vibration. It is immaterial, so far as the present argument is concerned, whether the regurgitant stream, or the current from auricle to ventricle or both these agencies, are the exciting cause of the valvular vibration, since the occurrence of the phenomenon as a cause of the murmur is all that is postulated.

The rare occurrence of a tricuspid presystolic bruit is accounted for by the difference in the arrangement of the valvular flaps, as compared with that at the mitral orifice, and also by the fact that the force and rapidity of the blood-current are seldom, if ever, so great through the tricuspid opening as through the corresponding aperture on the left side of the heart. It occasionally happens, however, that one or other of the flaps is thrown into vibration with the production of a presystolic tricuspid murmur.

INFANTILE PARALYSIS.[1]

By GUTHRIE RANKIN, M.D., F.R.C.P. (Edin.), M.R.C.P. (Lond.),
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I HAVE selected, as subjects for two formal lectures of this Session, Infantile Paralysis and Progressive Muscular Atrophy. The reasons which have prompted me to this choice are that the two disorders, although clinically so unlike each other, have a common pathological ancestry; that, though frequently enough met with in hospital wards, they are not so common in general practice as to make them familiar to everyone; and that both are possessed of characteristic features, which I am able to demonstrate by cases which will be brought before you in illustration of these notes.

To-day we will deal with Infantile Paralysis, otherwise known as acute anterior poliomyelitis, a disease first described by Heine in 1840, which, I need hardly remind you, is dependent upon a destructive lesion in the anterior horns of the spinal cord, and is manifested almost invariably in young children. It may occur in adults, but is most common in children under three years of age, and is especially frequently met with during the second year of life. The two cases, which are here for your inspection, illustrate this point, the illness having begun in the girl, when she was a little over a year old, and in the boy, when close upon two years of age. The following short synopsis, from the hospital record of these children, will enable you to appreciate how, between them, we get illustrated the whole story of the disease, as I am about to describe it to you:—

F. H., aged 3 years, was admitted to the Royal Waterloo Hospital on account of weakness in all four limbs, especially those on the right-hand side of the body. Rather more than a year ago, after complaining for a day or two of pain in his head, he had a convulsive fit which was followed by complete

[1] A lecture delivered in the London School of Clinical Medicine (Post-graduate), Seamen's Hospital, Greenwich.

paralysis of both legs and both arms. After a time, the left side become distinctly better. The family history is unimportant. He is an only child. There is no evidence of disease in any of the thoracic or abdominal organs, and the boy bears the appearance of health and intelligence. The pupils react normally to light and accommodation. Both knee-jerks are absent. There is marked wasting of the right thigh muscles, especially of the extensors. The right deltoid and the muscles of the right shoulder girdle are also atrophied, and there is partial dislocation of the head of the humerus. The right leg cannot be extended on the thigh, nor can the right arm be raised above the head. On the left side of the body, the muscular movements are normal, but very feebly performed.

L. A., aged 9 years, was admitted to the Royal Waterloo Hospital, on account of wasting and loss of power in her left leg. When rather more than a year old, this girl had some kind of fit, for which apparently she was kept in bed, and only after five months, when she first attempted to walk, was it discovered that she had lost power in her left leg. The family history is unimportant. Nothing abnormal can be found in the chest or abdomen. The child is intelligent and fairly robust. There is wasting of the left thigh and leg, particularly below the knee, and talipes equinus is well marked. The knee-jerk is absent on the left side. The gait is much impaired. The foot and leg are continually blue and cold, and the left limb is stunted throughout, and a full inch shorter than the right leg. The irritation of dentition is frequently assumed to be responsible for the onset of the disease, but there is no proof in support of the assumption. Exposure to cold was for a long time blamed for this, in common with many other disorders, but the fact that its incidence is greater in hot than in cold weather makes the theory unlikely. Parents, who are always anxious to find an extraneous cause for any form of paralysis, commonly ascribe the onset to a fall, or to an injury to the spine. The disease is sometimes met with in such a multiplicity of cases occurring together, that it almost assumes a character of epidemicity. Thus, in 1889, Medin reported an epidemic in Stockholm, in which 44 cases occurred during August, September, and October; in 1895, Caverley described an outbreak in Rutland, U.S.A., in which 144 cases declared

themselves between July and September; and numerous similar experiences have been recorded in London, New York, and elsewhere. This occasional epidemic prevalence, the seasonal preference, and many other facts support the view that, probably, the cause is a toxæmia rather than a localised inflammation, and that a micro-organism, yet to be isolated, or its toxins, possesses a spinal affinity for the cells of the anterior horns which, under favourable conditions, it assails and more or less destroys. The onset of infantile paralysis is always sudden, but is occasionally preceded, for a day or two, by fretfulness or general malaise. It is attended by a rapid rise of temperature to 102° or more, quick pulse, flushed face, restlessness, and not infrequently by vomiting, or diarrhœa. In a small proportion of cases, there is no febrile onset, the child, while in a state of perfect health, being suddenly paralysed in one or more limbs. Sometimes the illness is ushered in by convulsions. The two children before us are examples of this type of onset. The initial symptoms are usually ascribed to a feverish cold, but, after they have lasted for from a few hours to a day or two, it is discovered that the child has developed a paralysis affecting one, two, or even all four limbs. A much longer period sometimes elapses before the loss of power is observed. This little girl is a case in point. Her mother did not become aware that she had lost the use of her left leg until four months after her initial "fit." The child was in bed all the time, and only when she first attempted to walk was the fact of her paralysis first realised. Among careless parents such an oversight is not so rare as might be expected. In children old enough to describe their symptoms, pains in the limbs, a dull aching in the back, and headache may precede, or accompany the paralysis. Sensation remains otherwise unimpaired. In cases in which distinctive sensory phenomena are present, the chances of the case turning out to be one of peripheral neuritis rather than one of infantile paralysis must not be overlooked. The bladder and rectum retain their normal functions; any serious interference with one or the other should suggest the possibility of the underlying pathological change being of the nature of a true myelitis. The palsy varies in extent, but it is complete from the first sudden onset, and never spreads beyond its original distribution. The

lower limbs are more frequently paralysed than the upper ones. In a majority of instances, one limb only is affected, but both legs may be involved, more rarely both arms, more rarely still all four extremities. This small boy is one of the rare examples of the disease, when both the lumbar and cervical enlargements of the cord are attacked, and in which all four limbs are involved in the initial paralysis. When both legs are paralysed, one is usually more affected than the other, and the ultimate permanent disability is often entirely limited to the limb, which was originally most seriously implicated. In the case of the leg, the muscles below the knee suffer more frequently than those above it. As regards the arm, the intrinsic muscles of the hand may bear the brunt of the disease, but the deltoid suffers more frequently than any other single muscle. These points are strikingly illustrated in our little patients. Rare cases have been recorded, in which some of the thoracic, abdominal, or facial muscles have been invaded by the paralysis. All the muscles of the affected limb are not, as a rule, equally incapacitated, and even those muscles which are involved are not necessarily wholly so ; some of the fibres may escape, and continue capable of normal activity. If a cluster of anterior-horn cells, serving a group of muscles, is entirely destroyed by the morbid process, it necessarily means total permanent paralysis of the associated muscles, but if the group of cells is but partially affected, the correlated muscles will be proportionately disabled, but not wholly unfitted for work. The more complete the destruction of the multipolar cells, the more incurable will be the resulting paralysis. Similarly, the more extensive the lesion in the anterior horns, the more widespread must be the resulting muscular palsy. After having attained its maximum intensity, which, as already stated, it does rapidly, the paralysis remains stationary for a period varying from a few days to as many weeks. It then gradually lessens, and progressive improvement takes place in such of the muscles as are innervated from segments of the spinal cord, which have escaped the destructive incidence of the disease. In other words, recovery takes place from that portion of the initial paralysis, which is dependent upon shock, while the remaining portion, which results from destruction of anterior horn cells, is permanent and incurable. In every case

there is a regression from the original area of the paralysis, but there is no means of estimating any proportion between the initial and the later or permanent disability. Improvement is first declared in the muscles last affected, and recovery becomes complete in from one to three months where the neurons remain intact. When the deprivation of nerve-supply is permanent from destruction of the trophic centres, the muscles remain flaccid and immobile. In from 10 to 14 days, after the onset of the attack, they already show signs of atrophy, and give to electricity the usual reactions characteristic of degeneration. In many instances, this reaction of degeneration, which consists, as you will remember, in a diminution or loss of Faradic response, with an increased but sluggish Galvanic response accompanied by polar changes, can be demonstrated, before atrophy has become a notable feature of the condition ; and, occasionally, when the attack is severe, the diminution of Faradic irritability is distinct as early as the end of the first week. After about six months, the affected muscles are permanently paralysed, and yield no response to either form of electrical stimulation. The wasting has become a prominent feature, and, if a whole limb is involved, it hangs useless, shrunken, and is no better than a flail. After a further interval of time, it becomes rigid and deformed from fibrous contraction, and from the unopposed action of the remaining healthy muscles. Care must always be taken to differentiate between this late rigidity and the spastic paralysis dependent upon a lateral sclerosis ; the latter is always accompanied by increase of the reflexes, and is not associated with muscular wasting. The lesion of infantile paralysis being situated in the trophic centres of the lower segment of the motor tract, the reflexes are abolished in all situations, in which the innervation is derived from the seat of lesion in the anterior horns. Thus, if the lumbar enlargement is involved, the reflexes of the lower extremities will be interrupted ; whereas if the cervical enlargement has fallen a victim to the disease, the reflexes of the arms will be lost, while those of the legs remain intact.

After the disease is permanently established, the development of the affected limb becomes arrested ; the younger, therefore, the patient, the greater will be the ultimate dispro-

portion in length and girth between the sound and diseased limbs. In this girl, the affected leg is not only visibly thinner than its neighbour, but it is quite an inch shorter. There may also be luxation of one or more joints from loss of their muscular and tendonous support, as is very well portrayed in the boy's left ankle and shoulder. The circulation through the limb is feeble, which, in consequence, looks blue and feels cold. From slight irritation, the skin is liable to become the seat of indolent sores. In all cases there is a partial recovery of power, but complete restoration is unknown. Second attacks of the disease are almost unknown.

Laborde has divided the history of the disease into the following four stages, which are useful to remember :—

1. *An initial stage* of rapidly increasing paralysis, usually accompanied by pyrexia, and lasting from a few hours to a week.

2. *A stationary stage,* lasting from a week to a month.

3. *A regressive stage,* during which the paralysis passes away from all parts except those whose trophic centres are destroyed, lasting from one to six months.

4. *A chronic stage,* during which atrophy persists, and contractions or deformities may be developed.

When adults are attacked, a comparatively rare event, the sequence of symptoms is precisely the same as in children. Obviously, in them, there can be no arrest in the growth of tissues that have reached their full development.

The most important complications are the various deformities which may ensue in the paralysed limbs : the legs suffer much more frequently than the arms. Statistics seem to indicate that other forms of spinal cord disease—progressive muscular atrophy, lateral sclerosis, etc.—are more liable to develop in spinal cords, whose stability has been previously disturbed by an attack of anterior poliomyelitis, than in those which have been always normal.

As regards pathology, the disease is so seldom fatal that opportunities for post-mortem examination are rare. The lesion in the anterior horns is vascular in character, and, in the acute stage the appearances are those of an ordinary myelitis, limited to the anterior-horn region of the cord. The primary or exciting cause of the disorder is not yet ascertained, but

there is strong reason to suppose that some form of toxic irritant in the blood is the responsible agent, though why the process should always manifest itself through the spinal artery supplying the anterior horn, has not yet been explained. When a cord is examined, years after the occurrence of the disease, the cornua at the affected area are found shrunken, and the motor nerve-cells partially or entirely absent; the affected half of the cord is visibly smaller than the corresponding part on the sound side, the extent of shrinkage being proportionate to the severity of the attack. In the muscles, which are involved in the paralysis, the affected fibres are atrophied, and in a condition of granular degeneration. The interstitial connective tissue elements are increased, and, in extreme cases, the muscular fibres have disappeared entirely, and become replaced by tracts of fibrous tissue with intervening accumulations of fat. The lumbar and cervical enlargements of the cord are the most common seats of the disease, which is, in many instances, entirely limited to one or other of these situations.

Byrom Bramwell thus sums up what he regards as essential pathological facts:—

1. The lesion is an acute inflammation of the anterior horn of grey matter.
2. In most cases the inflammation is practically confined to this part of the cord.
3. It chiefly or exclusively involves the grey matter of the lumbar and cervical enlargements, all the segments of which may be, but more frequently some only are, implicated, usually bilaterally, but seldom symmetrically.
4. The lumbar enlargement is much more frequently affected than the cervical.
5. The severity of the inflammation is variable, being sometimes so slight that the chief result is an inflammatory œdema, at others so severe that there is more or less complete destruction of the multipolar cells.
6. The effect of the inflammation is to temporarily arrest, or permanently destroy, the function of the active

nerve elements, with a resulting temporary or permanent paralysis of the muscular fibres which they supply.

7. A nerve cell, once completely destroyed, is never restored.
8. The result of destruction of a nerve cell in the anterior horn is degeneration and atrophy of its axis-cylinder process of the motor nerve-endings, in which it terminates, and of the muscular fibres, with which these motor nerve-endings are connected.

The outlook, as regards life in infantile paralysis, is almost invariably favourable, but no opinion can be formulated as to the possible degree of recovery from the damage inflicted by the attack until the first severity of the seizure is over, though a certain amount of recovery from the initial paralysis is always to be looked for. When the paralysis has reached its acme, and has remained stationary for 24 hours or more, no further extension need be apprehended, while the risk of relapse or recurrence may be disregarded. Complete recovery is extremely rare. The earlier and the more pronounced the loss of normal electrical irritability is, the greater and more rapid will be the wasting, and the more unfavourable will be prognosis as regards ultimate recovery of power. Muscles, which respond to the Faradic current a month after the onset of the disease, will probably recover, while those that fail to respond will remain permanently more or less impaired. The disease does not in any way interfere with the normal development of the brain or other organs, but the parents should always be warned that the affected limb is certain to be stunted in its growth. The prognosis is more unfavourable in febrile cases than in those without an initial temperature disturbance.

In the diagnosis of the disease, it is a common mistake to ascribe the illness, in its initial phases, to chill, dentition, or the onset of one of the specific fevers. Later on such an error is rectified by the discovery of a flaccid paralysis affecting one or more limbs ; and, at a still later stage, corroboration is afforded by muscular atrophy, loss of reflexes, and altered electrical reactions. When an old-standing case is seen for the first time, the true explanation of the paralysis and atrophy

must be sought in the history of the mode of onset of the attack, and in the fact that the paralysis has not been progressive, but has remained wholly limited to the muscles which were suddenly rendered powerless when the disease first manifested itself as a pyrexial and acute malady. An arrest in development of the affected limb causing it to be, in all its structures, smaller than its neighbour, and also lividity and frigidity of its surface are minor points of confirmatory significance. Further differential characteristics are to be sought for in the absence of permanent sensory disturbances and of bladder or rectal troubles; also in the liability to progressive contractions in the affected limbs.

Infantile paralysis may be confounded with acute transverse myelitis, cortical disease of the brain, peripheral neuritis, or the pseudo-paresis of rickets; but difficulties in diagnosis are, in the large majority of instances, few, and, with reasonable care, mistakes are easily avoided.

In the treatment of the disease, the patient should be confined to bed during the acute stage. So far as possible, the dorsal decubitus should be avoided, and the application of sinapisms, or dry cupping to the spine, may be of some value in limiting the extent of the inflammatory disturbance, if they are applied before damage has actually been inflicted upon the anterior horn cells. The diet should be bland and simple, and food is best given in small quantities, and at short intervals. The bowels must be evacuated by a brisk aperient, and the administration of a simple diuretic and diaphoretic mixture will promote the subsidence of the temperature. In many cases, there is so much restlessness that bromides are required, which may be conveniently added to the febrifuge mixture. When the stationary stage is reached, tonics are generally indicated, and none will be found better, in the case of most children, than a combination of the syrups of the iodide and phosphate of iron, to which, after three or four weeks, it is frequently advisable to add strychnine, or nux vomica. The daily dietary should be so arranged as to supply the maximum of fatty nourishment that the child's digestion can deal with, and cod-liver oil should never be omitted.

For the first three or four weeks, the child should be

kept as much as possible in the recumbent position, either in bed, or on the sofa, but when all activity at the site of lesion is presumably over, it is desirable to have him out of doors, as much as the conditions of weather and the state of his general health will allow. Although of paramount importance, nothing in the way of local treatment should be attempted, until about a month has elapsed from the onset of the illness. It is then time enough to subject the affected limbs to the influence of massage, the continuous electric current and passive movements, all of which help to maintain the nutrition of the damaged muscles, and to stimulate conductivity in such nerve fibres as are not permanently destroyed. Active treatment should be persevered with for about eighteen months; by that time all the recovery that is possible is likely to have been achieved. Subsequent management should be directed to the maintenance of the general vigour, and to the prevention of deformities. If the latter cannot be completely prevented, at least much may be done to minimise the inconvenience they produce, by looking after the position of the paralysed limb, and by calling in the services of the orthopædic surgeon on the first indication of muscular contraction, so that suitable mechanical appliances may be requisitioned at the time when they are of the greatest service. Within the past few years, encouraging results have been achieved by the transplantation of tendons from healthy to paralysed muscles.

In the large majority of cases, the disease is established, and the damage done before advice is sought, but, even were it otherwise, nothing in the way of prophylaxis is possible in the present state of our knowledge. If, at some future time, the ætiological factor is proved to be bacterial, then we shall be within reach of some means of protection which will bring the incidence of the disease within the scope of preventive medicine.

THE RADICAL TREATMENT OF CANCER OF THE PROSTATE.

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[With Plates I. and II.]

From the point of view of radical operation, cancer of the prostate presents some favourable and many unfavourable characteristics. In the majority of cases it is a slow growing cancer, which is hemmed in by a tough sheath of fascia, and remains localised within the organ for a considerable period of its history. But the prostate is deeply placed, and, until symptoms arise, it is unlikely that the new growth will attract attention. The symptoms which it most frequently produces are to be referred to obstruction, either of the urinary outflow, or of the bowel, or to pressure upon nerves.[1] These symptoms require for their production a tumour of some extent, and it therefore follows that the surgeon seldom meets with the new growth in its earliest stages. The organ is, moreover, difficult of access where a complete dissection is desired. Further, the intimate relation of the prostatic tissue with the muscular floor of the bladder is such that an operation for cancer of the prostate, which stops short of removing the overlying portion of the bladder wall, courts an early recurrence of the disease. I shall not elaborate these points further, for the object of this communication is to review the methods that have been adopted for the radical treatment of cancer of the prostate.

RETROSPECT.

Operative interference in prostatic carcinoma was suggested, and a method of its performance was worked out, by dissection on the cadaver, by Küchler[2] in 1866. It was not until the following year, however, that an operation was undertaken on the living subject by Billroth.[3] A prostate, as large as a duck's egg, was removed through a lateral perineal incision, leaving a defect the size of a franc piece in the base of the bladder.

The patient recovered from the operation, and lived for 14 months, when he succumbed to a local recurrence of the growth. In a second case,[4] the same surgeon exposed a malignant prostatic tumour from the perineum, and scraped away portions of the new growth. On the fourth day the patient died of peritonitis. In 1873, Demarquay[5] published observations on two cases in which cancer had spread to the anterior wall of the rectum from the prostate. From one of these patients he removed, with the anterior wall of the bowel, the greater part of the gland, and the patient was still in good health two years after the operation. From the second he removed the rectum, the entire prostate, the membranous urethra, seminal vesicles, and base of the bladder. The patient died of pyæmia.

Ten years later, Spanton[6] attacked a large sarcoma of the prostate from the perineum. The growth proved so extensive, however, that the operation had to be abandoned, and the patient died of shock on the following day. In 1884, Harrison[7] described a case in which he explored the bladder by a median incision, and found a mass projecting into the prostatic urethra, and occupying the neck of the bladder. This was removed and the base scraped. The lobe was found to be carcinomatous. Incontinence of urine followed the operation, and, 14 months later, the groin glands became enlarged, and the patient died in two months. Leisrinck[8] removed the whole prostate through a perineal incision, but the patient died of exhaustion 13 days after the operation. In 1887, Heath[9] operated upon a case by perineal section, but the patient died of anuria 30 days later. In the same year Belfield[10] performed partial prostatectomy from the perineum on a malignant growth of the prostate. The patient died of recurrence four months after the operation.

Three cases, operated upon by Czerny, were recorded by Stein[11] in 1889. One of these was a growth the size of an apple situated in the left lobe. The suprapubic route was first unsuccessfully tried, and then the whole gland was removed by the perineum. A suprapubic fistula remained, and the patient died in 18 months. In a second case, the growth had invaded the anterior wall of the rectum. The urethra was cut across at the apex of the prostate and the bladder almost at

the upper margin of the trigone. The operation was completed by suturing the bladder to the urethra. The patient died from pneumonia 12 days after the operation. In the third case, the growth was curetted with a sharp spoon. In 1891, Parona[12] removed the middle lobe of a carcinomatous prostate. The patient died some months later. In 1892, Socin and Burckhardt[13] removed a sarcoma of the prostate the size of two fists. The growth was readily shelled out through a para-rectal incision. The patient remained well for $4\frac{1}{2}$ years, when the growth recurred, and he died $5\frac{1}{2}$ years after the operation. A similar operation was performed by von Frisch,[14] in 1898, in two cases of adeno-carcinoma of the middle lobe. Both patients were well a year after the operation. Fuller[15] operated, in the same year, on a case of malignant disease of the prostate by the suprapubic route, and removed the whole prostate and a portion of the bladder wall. The patient died of recurrence 11 months after the operation.

Verhoogen[16] removed, in 1898, a myosarcoma of 12 centimetres diameter. The prostate was cut away from the bladder base with scissors, so that an opening 3 centimetres in breadth remained into the viscus. This opening was partly closed with stitches, and partly fixed to the membranous urethra. Unfortunately, the stitches did not hold, and a fistula remained. Complete control over the bladder function was regained after the operation. Recurrence in the scar took place, and the patient died nine months after the operation. This author quotes a case, operated by Depage by the perineal route, the patient dying on the ninth day.

Adenot[17] showed, before the Lyons Medical Society, a specimen of malignant prostate, which he had removed from a man of 56 years. He used a pre-rectal incision, incised the capsule of the prostate, and excised the whole gland, partly with curved scissors, and partly by shelling it out with the fingers. The urethra was carefully preserved. The cavity left, after removing the prostate, was a little larger than a lemon, the pelvic floor was restored by sutures, and the cavity drained. The patient died $4\frac{1}{2}$ months later of cachexia. In this year, Jacobson[18] operated by suprapubic prostatectomy on a man of 61 years. The lateral lobes were enucleated. The patient died of recurrence in six months. Young[19] also

performed a suprapubic operation upon a patient, aged 67, after removing a large vesical calculus. The growth had recurred extensively 3½ years later.

In 1902, Harris[20] removed the whole prostate and prostatic urethra and nearly the whole of the bladder. He transplanted the ureters into the remaining apical portion of the bladder, and drained the cavity through a catheter in the urethra, but made no attempt to suture the bladder and urethra. There were extensive metastases, when the patient died 2 months later.

Two cases of suprapubic removal of carcinomatous growths of the prostate were recorded by Harrison[21] in 1903. Portions of the growth were removed piecemeal. Recurrence took place, and the patients died in four and six months respectively. Greene[22] enucleated the lobes of a carcinomatous prostate in a man, aged 59, but the patient was not traced after recovering from the operation. In this year also, Young[23] operated suprapubically on a patient aged 75. Recurrence and death followed in one year.

Pousson[24] records 4 cases which he has treated by operation. He used the perineal route in all these cases. In one case, the malignant nature of the growth was only discovered after the operation, and this patient was well when last seen 3 months afterwards. Of the remaining 3 cases, malignant disease was suspected in 2, and diagnosed in 1.

In one patient, the bladder was found to be invaded by the growth on one side. This was curetted, but the patient died cachetic 5 months after the operation. Another, in whom the rectum was perforated during the operation, and a recto-urethral fistula followed, died cachetic in 5 months. One patient had no recurrence 9 months after the operation.

Young[25] published 4 cases of complete extirpation of the prostate, prostatic urethra, seminal vesicles, and bladder floor covering the prostate.

METHODS OF OPERATION.

In the foregoing retrospect, it will be seen that the incision, and the method and extent of operation, varied greatly.

Para-rectal, pre-rectal, lateral perineal, median perineal, and suprapubic incisions are all to be found among these records.

One thing is evident. The operation was not always undertaken with a clear idea of the nature of the growth, sometimes indeed the diagnosis was only made after microscopical examination of the tissue removed. Again the method and extent of operation have varied. In one case, the operation consisted of removal of the anterior rectal wall, the prostate and a portion of the bladder wall, while, in another, a projecting intravesical lobe was wrenched out through a boutonnière incision, and, again, no more than a curettage of the growth was attempted in another.

The cases, in which a radical cure was attempted, may be divided into those in which the growth was confined to the prostate and only that organ required removal, and those when the bladder, or rectum, or both were affected.

Carcinoma of the prostate, as I have already remarked, is slow to pass beyond the limits of the prostatic sheath. These cases of rectal and vesical involvement were examples of the most advanced stage of the disease. With modern accuracy of diagnosis, the nature of these cases is known before they reach the stage of spread to the rectum and bladder. Such formidable operations, as those performed by Demarquay and Billroth, are not likely to be undertaken even should the complete extirpation of prostatic carcinoma become the rule.

I shall therefore confine the following remarks more particularly to the removal of malignant growths of the prostate which have not involved other viscera. The routes open to choice are the suprapubic and perineal. I shall first consider the suprapubic method.

I.—SUPRAPUBIC OPERATIONS.

(*a*) With the introduction of a rapid and complete suprapubic method of removal of the adenomatous prostate by Freyer, an impetus was given to suprapubic operations. It was unavoidable that some of the cases that were looked upon as adenomatous enlargements of the prostate should turn out to be malignant in nature, for the importance of a careful selection of cases for the operation was not at first evident.

The so-called fibrous prostate was found to shell out badly, or not at all, by the Freyer method. I have elsewhere

referred[26] to these so-called fibrous prostates, and mentioned two cases, on which I had operated, and which were found to be malignant in nature on microscopical examination. On opening the bladder in such a case, it is found that the prostate does not project into the bladder, or at most forms an intravesical rim around the internal opening of the urethra. The mucous membrane around the internal meatus, and covering the upper surface of the prostate, is tough and leathery, and does not glide over the surface of the prostate. With the forefinger of one hand in the rectum, and that of the other on the upper surface of the prostate, this organ may be fixed, but again it may present so much mobility as to lull the operator to a sense of security in regard to the nature of the disease. One lobe will often be felt harder than the other, and, sometimes passing outwards and backwards from this in the direction of the ureter, a thickened track of tissue may be palpated between the fingers. The internal meatus is rigid. The forefinger, forced into it, is held as in an iron ring. Attempts to commence enucleation, by forcing the forefinger through the posterior wall of the prostatic urethra, or through the mucous membrane on the vesical surface of the prostate, are unavailing, or only succeed after a struggle. The assistance of scissors or a knife may be required. It is sometimes possible to get a start outside the ring of hard tissue, but the toughest part of the growth may lie towards the sheath rather than at the urethra. In any case, the digital enucleation, once commenced, continues with much difficulty, and without any line of guidance, until finally several masses of tissue of india-rubber-like consistence are torn out. There remains a space the size of an egg-cup, with walls of a tough leathery consistence, from which scraps of tissue may still be scraped. The bleeding from this cavity is remarkably slight.

I have met with two cases of this type, which I shall briefly summarise.

S. B., a feeble old man of 72, was sent to me by Dr. G. H. Darwin, of West Didsbury, with a history of three years' difficulty in micturition. There was some pricking at the end of the penis on walking. His urine was foul, and his general health had been failing for two years. I crushed a large

phosphatic calculus, and washed his bladder, but his difficulty continued. The prostate was enlarged and rather hard, and there were eight ounces of residual urine. I decided to perform prostatectomy, and met with the difficulties which I have described above. The patient died of shock 15 hours after the operation. There were carcinomatous glands along the internal iliac artery and the right side of the aorta. The portions of tissue removed and the wall of the cavity were carcinomatous under the microscope.

S. R., a healthy looking man of 74 years, had suffered from increasing difficulty in micturition for some months. There was increased frequency during the day, and he rose twice at night. The prostate was enlarged and firm, with a hard ridge in the right lobe. Operation was desired by the patient.

After opening the bladder the prostate was freely movable, and the mucous membrane of the bladder base soft and pliable. A hard cartilage-like ring surrounded the internal meatus. After much difficulty I was able to burrow with the finger outside this ring, and remove it and several pieces of leathery tissue. A cup-like cavity remained, the walls of which were tough and leathery in consistence. Two months after the operation the patient was in good health, the bladder function perfect, and the urine clear.

Harrison has recorded two cases of a similar nature. He operated on one patient, of 64 years, and removed several portions of a very tough prostate; microscopically, the periphery of the mass was adenomatous, while the centre was carcinomatous. The growth recurred, in three or four weeks, in the original site, a permanent suprapubic fistula was established, and the patient died, four months after the operation, with secondary growths in his spine.

From a second patient, of 61 years, what was apparently a fibro-adenoma of the prostate was enucleated, after some difficulty, in two pieces by the finger. Microscopically, some parts were carcinomatous and others adenomatous. The bladder function was restored; 16 months later the abdominal cicatrix and groin glands were infiltrated with cancer, and the legs and scrotum œdematous. Freyer[27] mentions that, in performing suprapubic prostatectomy, examination of the prostates removed showed, in three instances, that the disease was

malignant, though in only one case was there any suspicion beforehand of the true nature of the disease. "One of the patients died 20 days after the operation, when the wound was practically healed, and when he was passing urine naturally. The remaining two cases made fairly good recoveries."

(*b*) Another type, of which I have met two examples, has the characteristics of an adenomatous prostate, and the enucleation proceeds smoothly, except at some part of the prostate, which is firmly adherent to the sheath.

(1) General C., aged 81, had complained of prostatic symptoms for some years, and had used a catheter to empty his bladder. I saw him, in April, 1906, in a severe attack of septic cystitis and pyelitis. The prostate was large, movable, elastic, with a regular smooth surface, and no enlarged glands could be detected. I operated, in June, after the attack had subsided. The prostate projected into the bladder as a cone, and the enucleation was easily commenced by pushing the finger through the posterior wall of the urethra. Some difficulty was experienced at the posterior part of the left lobe, and the right lobe was so firmly bound down to the sheath that it was only torn away after a struggle. The wall of the cavity was thick and leathery. Microscopical sections showed that this prostate had the appearance of a simple enlargement at some parts, but at others the characters of acinous carcinoma were present. Two and a half months after the operation the patient died of renal failure, without any local recurrence or metastatic deposit.

(2) R. T., aged 71, had for six months suffered from suprapubic pain, and difficulty in micturition. There was some nocturnal frequency of micturition. The prostate was enlarged, and the right lobe was harder than the left, and rather fixed. There were no enlarged glands. He decided to have an operation performed.

On opening the bladder, the prostate was found to project well into the cavity, and was freely movable except on the right side. The mucous membrane of the bladder base was not infiltrated. The left lobe was easily shelled out. A portion of the right lobe came away easily, but the remainder was firmly bound down to the sheath, and an alarming attack of respiratory failure precluded further attempts at

clearing it away. On section, the left lobe and a portion of the right were found to be carcinomatous. The convalescence after the operation was uneventful. The patient succumbed, three months after the operation, to an attack of bronchitis. There were no symptoms of local recurrence, or of generalisation of the growth.

(*c*) There is still an earlier stage of this type of carcinoma of the prostate, which is met with in operative surgery.

In tabulating and commenting upon 16 cases of malignant disease of the prostate, in the records of the Middlesex Hospital,[28] I referred to a case that had been operated upon by one of the surgeons to that hospital (Case 15, S°. R., 1052). Suprapubic prostatectomy was performed, and the patient discharged well. On microscopical examination, the structure of the prostate was found to be a large spheroidal cell carcinoma of the alveolar type. In this case, the symptoms of simple enlargement had persisted for 12 years, and the prostate, on clinical examination, had the usual characteristics of a benign enlargement of the prostate. There was no unusual difficulty in performing the enucleation. Nor was any appearance of malignancy in the specimen noted, before it was submitted to section and microscopical examination. "These facts," I commented, "would appear to leave little doubt that the malignant process started in a gland, which had, already for some years, been the seat of simple enlargement." The occurrence of malignant growth in a "hypertrophied" prostate is a point of some interest from the pathological standpoint, and of undoubted importance to the clinician. Apart from stone formation, which is necessarily rare in this connection, it is the only definite "pre-cancerous" condition as yet described.

Young relates the case of a man, of 67 years, on whom he practised suprapubic prostatectomy. The prostate, which came away in one piece, appeared to be benign. On section and microscopical examination, the prostate was found to be carcinomatous. The patient was well for $3\frac{1}{2}$ years, when he began to show symptoms of metastatic deposit in the retro-peritoneal glands, stomach, and liver, and local recurrence in the prostate. He died nearly four years after the operation.

Pousson examined 16 specimens of enlarged prostate, which

he had removed as benign, and found by the microscope that two were malignant.

(*d*) A more extensive operation, by the suprapubic route, was that performed by Fuller, in 1897. This surgeon found, on opening the bladder, in a man of 69 years, that, in addition to the enlargement of the prostate, previously supposed to be benign, a growth had spread from the prostate, and involved the bladder wall covering it, and had extended upward "so that the anterior wall to either side of the urethral outlet was somewhat infiltrated." With serrated scissors, he made a circular incision through the vesical wall, including the involved area and the area around the urethral opening. With the forefinger, this portion of the bladder wall, with the adherent prostate, was dissected up. The prostatic urethra was cut across near the membranous portion. The mass came away in several pieces, and the anterior vesical wall was accidentally torn up to the suprapubic incision, so that the posterior surface of the pubic bones was laid bare. The vesical wall was fixed to the abdominal wound, and a large drain inserted. Another drain was introduced through a counter incision in the perineum. No attempt was made to close the rent in the anterior vesical wall. The wound closed, and normal urination was restored.

Recurrence took place, nine months later, in the space of Retzius, and the patient died 11 months after the operation.

2.—PERINEAL OPERATIONS.

The greater number of operators have attacked malignant growths of the prostate by the perineal route, and the operations have varied according to the extent of the growth. It is only necessary to refer to operations that are intended for the removal of malignant disease confined to the prostate gland.

(*a*) The perineal operations, introduced for the removal of benign enlargement of the prostate, have been most frequently used.

The method of exposing the posterior surface of the prostate from the perineum, preparatory to enucleating the gland, originated with O. Zuckerkandl,[29] Proust[30] of Paris, has elaborated the technic, and some further changes were

made by Albarran. The details of Proust's method have already been described, and illustrated in THE PRACTITIONER,[31] hence only a short note is necessary. The patient is placed in the "sacra-vertebral" position, and a long curved incision, with the convexity toward the bulb, made in front of the rectum. The bulb is separated from the sphincter ani, the recto-urethral muscle cut through, and the space between the prostate and rectum opened up, the levator ani being separated with the forefingers. The urethra is incised longitudinally at the apex of the prostate, a prostate depressor (Proust's, Albarran's or Pezzer's) introduced into the bladder, and the prostate made prominent in the wound. The capsule (sheath) is split along the middle line posteriorly, so as to expose the glandular tissue, and the gland and sheath are separated with the finger so far as possible. The urethra is next further opened, and the forefinger introduced after removal of the depressor. One lobe is dissected off the urethral wall with scissors, using the finger in the urethra as a guide ; the lobe is then separated from the bladder base. The lobe is now held by a narrow pedicle which contains some vessels. The second lobe is treated in the same way. The urethral incision is either closed with sutures, or left open for drainage.

Albarran[32] carries out a somewhat similar operation, but by *morcellement*. He removes first a portion at the apex of one lobe, then the apical portion of the other ; he then pushes the forefinger into the bladder, makes the vesical portion of the prostate prominent, and removes this in the same way. A pedunculated median lobe is removed by incising the urethra at its neck, and a sessile lobe by incising the vesical mucous membrane and enucleating it.

Pousson records four cases of carcinoma of the prostate, which he treated by perineal prostatectomy after this method.

(1) A man, of 57 years, was supposed to suffer from simple enlargement of the prostate. Microscopical section of the prostate revealed its malignant nature. The bladder function was completely restored, and the patient was well three months after the operation, but was lost sight of.

(2) From a patient, of 54 years, a malignant enlargement of the prostate was removed, and the bladder neck was

found to be involved. This was curetted. The patient died cachectic five months after the operation.

(3) A third patient was submitted to perineal prostatectomy, at the age of 62 years. The bladder function was unimpaired, and his health was perfect nine months after the operation.

(4) A man, of 66 years, with a large nodular malignant growth of his prostate. A recto-urethral fistula followed the operation, and recurrence of the growth was fatal in five months.

(5) Fournier[33] quotes another case operated by this surgeon. In a man of 56 years perineal prostatectomy was performed in March 1903, and the patient was making good progress a month after the operation.

Gayet[34] related the case of a man of 60 years, on whom he performed perineal prostatectomy, and the growth had to be removed by *morcellement*. The patient left the hospital five weeks later with a normal bladder function and without recurrence.

Adenot[35] also described a case, but the patient died of cachexia 4½ months after the operation.

(*b*) More complete operations by the perineal route, for the extirpation of the carcinomatous prostate, have been performed by various surgeons. The first part of all of these operations has been the same, although the actual line of the skin incision has varied.

The posterior surface of the prostate was thoroughly exposed by dissection in the manner just described, the levatores ani being either pulled aside, or incised, or portions cut away, where they appeared to be invaded with growth. The membranous urethra was then cut across, and the prostate drawn backwards, and detached from its anterior adhesions. Then followed either dissection of the prostate from the bladder base, leaving the muscular floor entire, or the removal of a portion of the bladder base with the prostate, saving, if possible, the ureteral orifices. The opening in the bladder was reduced in size by sutures, and then stitched to the severed end of the membranous urethra.

Demarquay removed the entire prostate, membranous urethra, seminal vesicles, and a part of the bladder base, but

his patient died of pyæmia. Czerny performed a somewhat similar operation, cutting into the bladder almost at the posterior part of the trigone, and finishing the operation by suturing the bladder and urethra. Leisrinck also cut into the bladder at the base, and, after removing the tumour, sutured the bladder and membranous urethra.

Verhoogen removed the prostate, cutting away three centimetres of the bladder base, and severing the membranous urethra. The bladder opening was reduced in size, and sutured to the membranous urethra. In another case, he again sutured the bladder to the membranous urethra.

Oraison [36] thus comments upon the various procedures.

"The plan that surgeons propose to follow is this:—Detaching the rectum, transverse section of the membranous urethra, lateral freeing of the prostate, transverse section of the bladder almost at the neck, suture of the urethral margin with the margin of the bladder wound."

Most of the operators comment upon the ease with which the bladder is brought down to meet the membranous urethra.

Proust,[37] in 1900, made numerous dissections on the cadaver in order to determine which of the various methods was the best. He used a large V-shaped incision, placed transversely so that one limb curved in front of the rectum, and the other passed obliquely forwards over the bulb. The posterior surface of the prostate was fully exposed, and the membranous urethra cut across. The prostate was turned backwards, and dissected off the bladder base. The vesical meatus was attached to the membranous urethra, and the levatores ani brought together by several stitches.

Young, of Baltimore, has recently published a description of a perineal operation, undertaken by him for the removal of cancer of the prostate. I give the description in his own words:—

"An inverted V cutaneous incision was made in the perineum, as in the operation performed by me for simple hypertrophy of the prostate, each branch of the incision being about 2 inches long. By blunt dissection, the end of the bulb and central tendon were exposed and the latter divided, exposing in turn the recto-urethralis muscle, the division of

which gave free access to the membranous urethra behind the triangular ligament. Urethrotomy upon a grooved staff was followed by introduction of the prostatic tractor, which was opened out after it reached the bladder. While traction was made upon this instrument, the rectum was carefully separated from the prostatic capsule by blunt dissection, until the entire posterior surface of the prostate was brought into view. Up to this point, the operator proceeded exactly as in the usual prostatectomy operation. The tissues around the prostate were more hæmorrhagic, and the wall of the rectum more closely adherent to the capsule of the prostate than usual. Examination of the prostate then showed much greater induration than I had ever remembered in a benign prostate. The rectum and the periprostatic tissues were free from invasion. Complete excision was therefore decided upon, and carried out as follows :—

"The handle of the tractor was depressed, thus exposing the membranous urethra anterior to it, where it was easily divided transversely with a scalpel, leaving a small stump of the membranous urethra protruding from the posterior surface of the triangular ligament. By further depressing the handle of the tractor, the puboprostatic ligament was exposed, and being very tautly drawn, easily divided by scissors, thus completely severing the prostate from all important attachments (except posteriorly), shown in Fig. 1. The lateral attachments, which are slight, were easily separated by the finger. During these manipulations, a moderate amount of hæmorrhage was encountered (coming from the periprostatic veins, particularly those just behind the triangular ligament in front of the prostate), but it was easily controlled by clamping several bleeding points, and applying pressure with gauze by means of an anterior deep retractor. The posterior surface of the seminal vesicles was then freed by blunt dissection, the now mobile prostrate being drawn well out of the wound. In this exposure of the posterior surface of the vesicles, I was careful not to break through the fascia of Denouvilliers, which covers not only the posterior surface of the prostate, but also of the seminal vesicles, and which forms, I believe, an important barrier to the backward growth of the disease.

"The next step was to expose the anterior surface of the

bladder, which was easily done by depressing the tractor and making strong traction.

"By this procedure the bladder was drawn down so close to the skin wound that it was easily incised at a point in the middle about 1 cm. above the prostato-vesical juncture. (Fig. 2.)

"By means of scissors, the division was continued on each side until the trigone was exposed, Fig. 4. After swabbing away the blood and urine, the ureters were easily found, and the line of incision carried across the trigone with a scalpel so as to pass about 1 cm. in front of the ureteral orifices.

"While still making traction upon the prostate, the base of the bladder was pushed upward with the handle of the scalpel, thus exposing the anterior surface of the seminal vesicles and the adjacent vasa deferentia, all of which were carefully freed by blunt dissection with the finger as high up as possible, so as to remove, with the vesicle, as much circumjacent fat and areolar tissue as possible, on account of the lymphatics which they contained. The vasa deferentia, after being drawn down as far as possible, were picked up on a small blunt hook and divided with scissors high up, care being exercised to see that the ureters were not in danger. (Fig. 3.) After division of the vasa, the seminal vesicles were found to come down more readily, and the deep adhesions were finally divided, and the mass removed. A portion of the membranous urethra, the entire prostate with its capsule intact, the seminal vesicles, 4 cm. of the vasa deferentia, and a cuff of the bladder 1 cm. wide along the anterior and lateral surfaces and 2 cm. wide in the region of the trigone, have been removed in one piece. There now remained a large defect to be repaired. The vesical opening was about 8 cm. in diameter, and had sunk far back into the depths. The stump of membranous urethra had been obliterated by the compression of the anterior retractor, so that it was necessary to insert a soft rubber catheter through the urethra from the meatus to discover it. The anterior wall of the vesical opening was then caught in forceps, and, with no great traction, I was surprised to find how easily it could be drawn down to the membranous urethra, where an anastomosis was readily made. The first suture was placed by inserting the needle into the triangular ligament above the urethra and out

PLATE I.

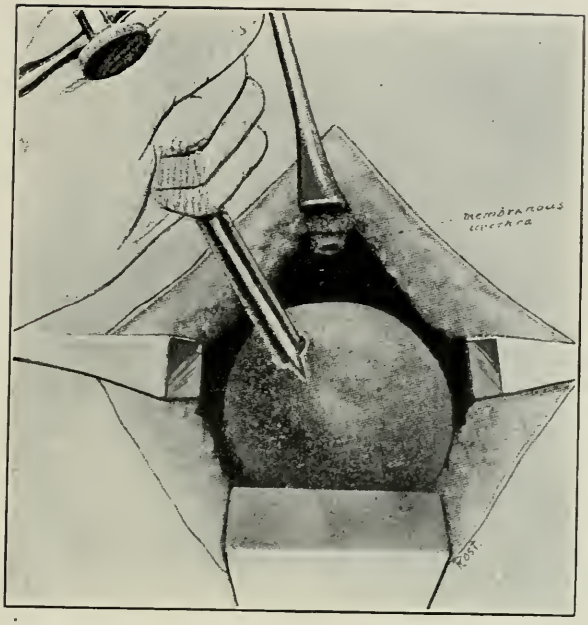

Fig. 1.—*After transverse section of urethra.* (*Young.*)

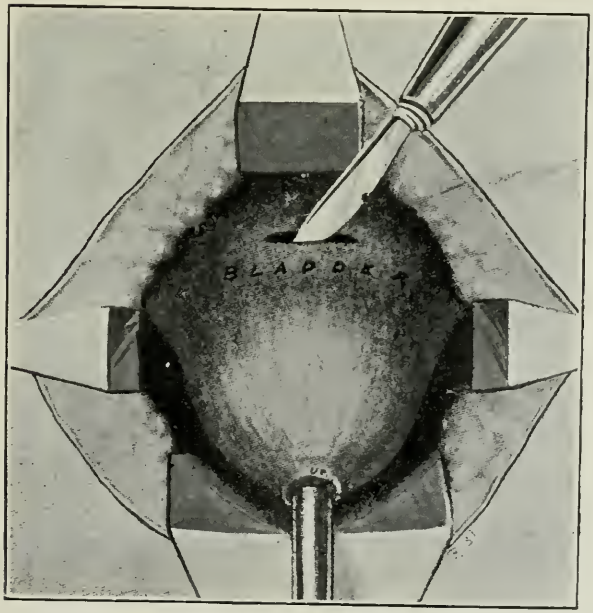

Fig. 2.—*Incision into bladder just above prostate.* (*Young.*)

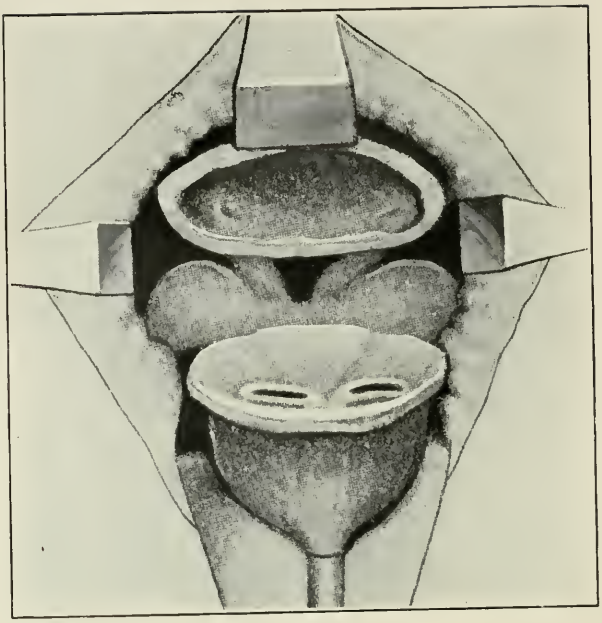

Fig. 3.—*Final separation of seminal vesicles and division of vasa.* (*Young.*)

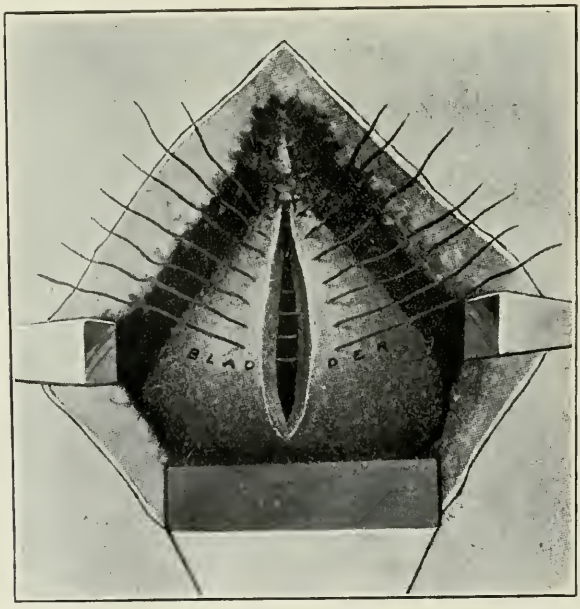

Fig. 4.—*The anastomosis of anterior wall of bladder to urethra has been made. The rest of vesical opening is being closed.* (*Young.*)

through the anterior wall of the membranous urethra, then through the anterior wall of the bladder in the median line from within out, care being taken to include only the submucosa and muscle. When this suture was tied, the median line of the anterior wall of the bladder was drawn to meet the median line of the roof of the remaining membranous urethra, the knot being outside and the thread left long.

"Lateral sutures similarly placed (including the periurethral muscular structures below), and two posterior sutures completed the anastomosis of the membranous urethra with a small ring into which the anterior portion of the margin of the vesical wound had been fashioned by the tying of the sutures. (Fig. 4.) The remainder of the vesical wound now presented as a longitudinal opening, which was easily closed by sutures, thus completely closing the defect, and replacing the prostatic urethra with a funnel-shaped process made from the bladder wall. The sutures used were silk, one end of each being left long and brought out of the wound, so that they could be extracted later (since then I have found alternate sutures of catgut and silkworm gut, also left long, the best). After light gauze packing had been placed in various portions of the wound, the levator ani muscles were drawn together with catgut (two sutures) in front of the rectum, and the skin wound closed on each side with interrupted catgut sutures, leaving only a small portion open at the angle in front for exit of the gauze drainage.

"The retained rubber catheter was fastened in place by adhesive plaster around the penis, and the patient returned to the ward."

RESULTS.

Pousson collected *22* cases of operation for malignant growths of the prostate.

Of these, six died directly from the operation, a mortality of 31·8 per cent. But many of these operations were undertaken for growths, which had spread beyond the prostate to the adjoining organs. Further, several of the operations were by no means complete.

One patient died of anuria 30 days after the operation. Of the remaining 15 cases, the fate of *2* was unknown, 9 died

from recurrence in from 4 to 14 months. In 4 cases, the patients were well at the time of the publication, 3 months, 9 months, 2 years, and 4 years after the operation.

The cases operated upon by the suprapubic route, except that of Fuller, were, at the best, partial operations and recurrence was certain. The complete operation of Fuller was followed by a recurrence in 11 months.

The operations upon carcinomatous prostates, which had previously been adenomatous, were the most promising of those attacked by the suprapubic route, but, as the true nature of these growths was not known before the operations, they must rank rather as adenomatous prostates, which were unfortunately found to be malignant, than as malignant prostates, which give promise of successful removal.

The only cases of any value, in judging results, are those of Young's series operated by the perineal route. In these 4 cases, there was no operation mortality. One case died 6 weeks after the operation from septic pyelonephritis, without recurrence of the growth.

A second case died after litholapaxy, 12 months after the operation, and a small area of recurrent carcinoma was found.

The remaining two cases were well 12 and 13 months after the operation.

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METASTATIC AFFECTION OF THE PANCREAS IN MUMPS.

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THAT the pancreas may be involved in the general infection of mumps has long been known. Schmackpeffer, in 1817 (*Observatio de quibusdam Pancreatis Morbis*), drew attention to the fact, and suggested that abscess formation was readily possible in the gland, and might be followed by necrosis. This view he based on the parallel metastatic infection of other glands, such as the ovary, testis, and mamma.

Later writers of the older school, including Canstatt, Battenby, Andral, Mondière, Roboica, held the same quite unfounded view. In 1870, Friedreich, followed by Seitz and Deichoff, advanced the opinion that parotitis, occurring in connection with pancreatic disease, is always secondary to the pancreatic affection ; a view which is supported by Trubhart,[1] on the basis of certain cases, in which parotitis occurred after symptoms of pancreatitis, and in which coarse disease of the pancreas was found post-mortem. The known and not infrequent occurrence of parotitis, after various pathological conditions in the abdomen, lends colour to this view, but whether, in mumps, the affection of the parotid is ever secondary to that of the pancreas there is no sufficient evidence on record to determine. Primary orchitis, followed by parotitis, has been observed not infrequently in mumps, but I am not aware that the same has been noticed with respect to pancreatitis. By analogy with the testes, such a sequence of events would seem possible.

Fabre,[2] in 1887, found in 58 cases of mumps 12 cases of tenderness over the pancreas. Cuche,[3] in 1897, also called attention to the affection of the pancreas in mumps.

H. W. Jacob [4] published, in 1900, a case of acute pancreatitis occurring in the course of mumps. A boy, aged 10, had mumps ; on the fourth day severe vomiting occurred, followed by violent pain in the epigastrium ; fever ; enlarged pancreas felt ; persistence for three days ; subsidence ; recovery ; no sugar found in the urine. C. Priestley,[5] in 1900, records a case

of mumps with symptoms of acute pancreatitis. B. C. Stevens[6] also records a case: Boy, aged 10; severe mumps; temperature 101·4°; on the third day unable to open the mouth; on the fourth day vomiting, violent pain in the epigastrium; temperature 103·8°, pulse 120; furred tongue, dry skin, anxious face; not much abdominal distension; a sausage-shaped tumour felt in the epigastrium and left hypochondrium, lying behind the stomach; on the fifth day temperature 100·2°, glands subsiding, pain in pancreas severe; on the sixth day no pain, still tenderness; by the eleventh day all cleared up.

Pick[7] noted tenderness over the pancreas in 4 out of 20 cases of mumps. Simonin[8] states that of 652 cases of parotitis 10 presented symptoms of pancreatitis, viz., sudden fever, vomiting, pain over the stomach region, the whole course of the illness occupying not more than seven days. No sugar was found in the urine; there was no jaundice, and no interference subsequently with the functions of the pancreas.

Lemoine[9] records a case of mild mumps, followed by orchitis, and, a few days later, by violent epigastric pain, with vomiting, jaundice, and hæmatemesis. The patient died at the end of seven days. Post-mortem, the pancreas was found to be enlarged, weighing 190 grms. (normal weight 85 grms.). Histologically, there was hypertrophy of the glandular acini with commencing degeneration of the protoplasm and nuclei of the cellular elements. Nowhere was there evidence of sclerosis, or heaping up of embryonic cells. There was besides a considerable number of infective nodules at the level of the liver and spleen, and a large swelling compressing the common bile duct. This is the only record which I have been able to find of a post-mortem examination of the pancreas after death following epidemic parotitis.

In Nothnagel's[10] *Medicine*, under the article "Parotitis Epidemica," by H. Schott Müller, mention is made of disease of the pancreas and other organs, including the thyroid and thymus glands, in connection with mumps. In English text-books little reference is made to the subject. Eustace Smith, in Allbutt's *System of Medicine*, says:—"In one epidemic cases of gastro-intestinal derangement are noticed, with abdominal pains . . . ." Jules Comby, in the *Twentieth Century Practice of Medicine*, says "digestive manifestations have received little attention," but makes no mention of pancreatitis. He refers

to the slowing of the pulse during defervescence of mumps, a symptom which was prominent in the cases to be referred to below. Biernachi, in Bain's *Text-book of Medical Practice*, states that symptoms of acute pancreatitis may be observed.

I have recently had the opportunity of seeing an epidemic of 33 cases of mumps occurring in a boys' school. The ages of the patients ranged from 9 to 14, and, in addition, 2 adults were attacked. The longest incubation period noted, viz., that between the first and second case, was 25 days. The subsequent cases appeared in batches, and, as the boys lived in the same house, and mixed freely together, it was impossible to determine accurately the periods of incubation in each individual. In type, the disease was mild; the parotitis generally slight, and in no case very severe; the constitutional symptoms were ill-marked, or absent, in most cases, except those mentioned below. Two cases of orchitis occurred, both in boys who had reached puberty. Of the series, 5 cases presented symptoms pointing to a metastatic affection of the pancreas.

Case I.—E., aged 9. Slight swelling of the parotids; no constitutional symptoms.

4th day: Parotid swelling notably less; pain in the epigastrium; vomiting; constipation; furred tongue; temperature 101°; pulse 70; abdomen slightly distended; somewhat rigid; tenderness over epigastrium; no swelling to be felt.

5th day: Pain and vomiting continued; temperature 102·6°; pulse 62; distension of abdomen increased; marked tenderness; no tumour felt. Bowels moved by enema; stool constipated but showing nothing abnormal. Urine, specific gravity, 1·030; contained copious urates; no albumin; no sugar; acetone and diacetic acid present.

6th day: No vomiting; pain and tenderness less; temperature 99°; pulse 50.

7th day: No tenderness; temperature normal; pulse 44.

8th day: „ „ „ „ „ 48.

9th day: No tenderness; temperature normal; pulse 60.

11th day: Quite well.

Case II.—F., aged 10. Parotid swelling slight; temperature 99·2; no other symptoms.

3rd day: Vomiting; pain in epigastrium; tenderness; furred tongue; constipation; temperature 101°; pulse 84.

4th day: No vomiting; pain less; tenderness still present; no tumour felt; temperature 100·4°; pulse 76. Urine contained no albumin, no sugar; acetone and diacetic acid present.

5th day: No pain; very slight tenderness; temperature normal; pulse 58.

6th day: No symptoms; pulse 50.

8th day: Well; pulse 68.

Case III.—C., aged 9. Slight parotid swelling; no fever; kept in bed on milk diet as a precaution.

4th day: Slight pain and tenderness over the epigastrium; no vomiting; temperature 100·2°; pulse 90. Some distension of the abdomen; no swelling to be felt. Urine did not contain acetone nor diacetic acid.

6th day: Well; pulse 75.

Case IV.—B. I., aged 11. Slight swelling of the parotids; temperature 99°; kept in bed.

4th day: Glands subsiding; temperature normal; allowed up.

6th day: Not so well; complains of feeling sick.

7th day: Vomiting; pain and tenderness in epigastrium; temperature normal; pulse 78.

8th day: Vomiting incessant; nothing retained; even water in sips rejected; vomit contained bile and viscid ropy mucus. Submaxillary glands noted to be swollen. Epigastric pain continued, though not severe. Abdomen not distended; a tender swelling felt lying transversely in the epigastrium and left hypochondrium. Temperature normal; pulse 80. Urine, specific gravity, 1·028; copious urates; no albumin nor sugar; acetone and diacetic acid present. Bowels constipated; cleared by enema; nothing abnormal in the motion; nutrient enemata given.

9th day: Vomiting continued; tenderness and swelling still present. Temperature normal; pulse 88.

10th day: Vomiting less; small quantities of milk retained; no pain; tenderness diminished; swelling less marked; pulse 65.

11th day: Better; eating light food; tenderness and swelling almost gone; pulse 58.

12th day: Convalescent; pulse 52.

13th day: „ „ 60.

17th day: Well; pulse 70.

Case V.—J. I., æt. 9; brother of Case IV. Slight parotid swelling; no fever; no symptoms; kept in bed on low diet.

7th day: Swelling of parotid subsided: boy apparently well.

8th day: Sudden vomiting; pain and tenderness in the epigastrium; furred tongue; constipation; temperature 100·2°; pulse 84.

9th day: Vomiting, pain, and tenderness continued; temperature 102·6; pulse 105; transverse swelling felt in the epigastrium.

10–13 days: Occasional vomiting; no pain; slight tenderness; gradual subsidence of the swelling; temperature varied from normal to 101°; pulse from 72 to 90; taking light food.

14th day: No vomiting; no tenderness; temperature normal.

16th day: Recovered; taking ordinary food.

Mr. P. J. Cammidge kindly examined for me a sample of the urine of Case V. taken on the ninth day from the onset of the mumps; that is, on the second day after the appearance of symptoms of pancreatitis. He reports as follows:—"The specimen of urine shows a well-marked 'pancreatic reaction,' indicating active inflammation of the pancreas. The well-marked deposit of calcium oxalate crystals is also such as is frequently met with in pancreatitis. In other respects, the results of the examination differ from what is usually found in pancreatic cases. The large amounts of acetone and diacetic acid seen in this specimen, which indicate abnormal tissue waste, are only found, as a rule, in those cases of pancreatic disease in which the lesion has resulted in severe glycosuria. It is unusual, too, to find such a large excess of urea and phosphates in uncomplicated pancreatic conditions."

For the sake of contrast, a specimen from a mild uncomplicated case of mumps was also submitted to Mr. Cammidge, who reports: "There is no evidence, in this specimen of urine,

of any disease of the pancreas. Although the high specific gravity, and the excessive proportion of urea and inorganic salts it contains, suggest that it is somewhat concentrated, it does not exhibit any noticeable pathological character."

The features common to all cases were : rapid subsidence of the parotid swelling, vomiting, pain and tenderness in the epigastrium, and constipation. Fever was present in all except Case IV. In only two of the cases (IV. and V.) was a distinct swelling of the pancreas felt ; in the others distension of the abdomen rendered palpation difficult. In all, except Case III., acetone and diacetic acid were found in the urine ; glycosuria was not observed. Slowing of the pulse was a marked feature in some of the cases, notably in Case I., and is interesting as suggesting that the slow pulse, commonly observed in jaundice, and usually attributed to the action of the bile salts, may in reality be due to a concomitant affection of the pancreas. Case III. was a doubtful one, and, in the absence of the others, would certainly not have given rise to a suspicion of pancreatitis. It is not improbable that mild cases of pancreatitis are more common in mumps than is generally supposed, and may be readily overlooked.

Though not absolutely conclusive, the symptoms of the remaining cases appear to me to warrant a diagnosis of metastatic pancreatitis, and the comparative rarity of this complication of mumps is sufficient to justify their publication.

An interesting speculation is the possible occurrence, subsequently, of atrophy of the pancreas, which, if it should occur, would entail serious consequences. By analogy with the testicle, such a sequence would seem not unlikely. A closer analogy, however, is with the parotid gland, which, so far as I am aware, is never atrophied after mumps, in the absence of suppuration of the gland.

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OPHTHALMIA NEONATORUM.

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(*Continued.*)

II.—ANATOMY AND PATHOLOGY.

Anatomy.—The cases of intra-uterine anterior staphyloma, and children born with fully developed ophthalmia neonatorum seem to point to the fact that infection can take place some time before labour comes on, as will be discussed more fully when treating of the pathology. This infection, in most cases, seems to be a direct spread of the disease from the vagina to the liquor amnii, and so to the conjunctival sac. It is essential, therefore, that the epithelial bond of union between the eyelids should have separated before infection can take place. This I have shown elsewhere[1] takes place at the end of the fifth month of fœtal life.

When the child is born the eyelids are tightly closed, the skin being thrown into numerous wrinkles and covered with a fatty material. The margins of the lids are usually in contact with each other, but occasionally the upper lid is found overlapping the lower. When in contact the fatty meibomian secretion makes the union practically water-tight.

In the child at birth, as compared with the adult, the length of the palpebral aperture is small in comparison with the size of the conjunctival sac, this often adds to the difficulty of treating ophthalmia neonatorum in the newly born. The lining membrane is thrown into numerous folds in the fornices and over the surface of the globe. The margins of the lids are covered with fatty secretion from the meibomian glands, and with epithelial débris.

The following observations were based on the examination

[1] *Hunterian Lectures*, 1905.

of three healthy fœtuses at full term, in a good state of preservation. They were hardened in formol, two of them being cut in celloidin, and one in paraffin.

The Epithelium.—Over the lower part of the tarsus, this is much thicker than it is in the adult conjunctiva, owing, no doubt, to its close proximity to the margins of the lids, in which thickening first begins. It is here some five cells in thickness, and it is the only situation in which it is thicker than in the adult, and, like the rest of the epithelium of the conjunctiva, there is an absence of any flattened epithelial cells on the surface, the cells being cuboidal in shape. On the anterior part of the retrotarsal fold, the epithelium is only from two to three cells in thickness, being much thinner than the adult's epithelium in that region.

That of the bulbar conjunctiva is, again, not so thick as that of the adult, but, next to the epithelium covering the tarsus, it is the thickest part of the epithelium of the conjunctiva at birth. In the fornices at the bottom of the folds, the cells show signs of mucoid change to such an extent that, in the three cases examined, the basement membrane was completely bare in places, and would have allowed a ready entrance of organisms to the subconjunctival tissues.

The corneal epithelium is about three cells in thickness, but, to compensate for this, there is a great thickening of the substantia propria, both in comparison with the thickness of the sclera, and with that of the adult cornea. The subconjunctival tissue, in the region of the bulb, contains a quantity of elastic fibres, which are finer than those in the adult conjunctiva. There does not seem to be any elastic tissue in the subepithelial conjunctival tissue covering the tarsus.

In the fornices, the subconjunctival tissue is very loose, and rich in blood vessels and lymphatic spaces, but there is a complete absence of leucocytes, which do not appear until after birth, when the fornices become filled with mononuclear leucocytes and a few plasma cells, which spread later to the subconjunctival tissue covering the tarsus. In other lymphoid tissue, such as the tonsil, mononuclear leucocytes are present for several weeks before birth, and are evidently produced from the cells of those structures. In the conjunctiva

therefore, the lymphoid tissue is the result of irritation and is of new formation. There can be no doubt that the development of the lymphoid tissue in the conjunctiva is of the utmost importance in preventing infection of the conjunctiva.

At birth, as has been seen, there is no lymphoid tissue in the conjunctiva. That is to say, the cellular elements are absent, although the connective tissue in the fornices is very loose in structure. I have examined a number of conjunctivæ, removed after death from children of various ages from birth up to the fourth week, in which, so far as could be ascertained, there had been no previous inflammation, nor any silver nitrate, or other irritant applied at the time of birth. At birth the tissue is entirely free from lymphocytes and plasma cells. There is no evidence of the so-called germ areas of Ribbert, and hence I think that it is possible to exclude this theory of the origin of the lymphoid tissue. After the first few days, these cells begin to appear, chiefly around the vessels of the superficial layer in the superior fornix, but also, to a less extent, around the deep vessels ; these cells gradually increase up to the fourth week, when the lymphoid layer seems to be fully developed.

I have had the opportunity of examining the conjunctival sac of a child, one day old, in which silver nitrate had been applied at birth. In this case, the lymphoid tissue (mononuclear leucocytes) had developed to a greater extent than in the conjunctival sac of the child two weeks old, to which no irritant had been applied at birth, showing that the silver nitrate used in the prophylactic treatment of ophthalmia neonatorum is not only effective by its antiseptic action, but that it also produces a barrier of leucocytes against infection. The fact that these cells appear first in the fornix is probably due to the extreme richness of its tissue in endothelium and perithelium, as compared with the palpebral and bulbar conjunctivæ ; the rapidity with which the leucocytes form depends on the amount of irritation which the conjunctiva receives.

The normal conjunctival sac of the newly-born child was bacteriologically investigated by Koblank (*Fesch. f. Karl kuge*, Berlin, 1898), and, in 20 cases, was found to be sterile,

and later by A. W. Sikes (at the instigation of S. Stephenson), who found that, in two-thirds of the cases, it was sterile, and that the other third contained no pathogenic organisms.

It is probable that traumatism during the act of birth not infrequently predisposes to infection; indeed I have found multiple hæmorrhages into the conjunctiva in some cases of difficult labour.

Pathology.—Having shown that infection of the conjunctival sac in the infant is more liable to take place owing to the deficiency of epithelium, and to the layers of protective lymphoid tissue being undeveloped, we now come to the nature of the organisms which give rise to the condition.

Bacteriology.—The following organisms have been found as the cause of ophthalmia neonatorum:—

Organism.	Demonstrated by
Gonococcus	Schon, Widmarch, Haab, Schmidt-Rimpler.
Pneumococcus	Gasparrini.
B. Koch Weeks	Zur Nedden.
B. Influenza	Zur Nedden.
Staph. Pyog. Aureus	Axenfeld and Bietti.
B. Coli Communis	Axenfeld and Bietti.
Streptococcus pyogenes	Chartres.
B. Diphtheria (Klebs Loeffler)	Axenfeld.
Micrococcus luteus	Cramer, Schmidt-Rimpler.
Staphylococcus pyogenes albus	
Diplococcus meningitidis intracellularis?	Mayou.
Morax-Axenfeld Bacillus	Stephenson.

The organisms printed in italic have caused severe ophthalmia neonatorum indistinguishable from that caused by the gonococcus.

Stephenson gives the following order of frequency of the various organisms:—

(1) The gonococcus; (2) the pneumococcus; (3) the Koch-Weeks bacillus; (4) the diplobacillus of Morax-Axenfeld;

(5) the bacterium coli; (6) the Klebs-Loeffler bacillus; (7) the pneumobacillus; (8) common pyococci; (9) streptococci; and (10) micrococcus luteus.

The following table shows the frequency, with which the different organisms were found in my cases :—

Total number of cases, 40.

Organism.	No. of them found.	Per Cent.
1. Gonococcus	23	57·5
2. Staphylococcus	8	20
3. B. Morax-Axenfeld	2	5
4. B. Coli	2	5
5. Pneumococcus	1	2·5
6. Diplococcus intracellularis	1	2·5

Four cases in which no organism was found by smear or culture.

Mr. A. C. Hudson (house surgeon to Moorfields) found that in 16 cases of ophthalmia in infants, under 10 days of age, 14 were due to the gonococcus.

In describing the cases, I have divided them into three classes :—

(1) Severe, where there is a profuse creamy discharge, such as would lead to grave fear with regard to the condition of the cornea.

(2) Moderate, where there is moderate discharge, such as is met with in a case of Koch-Weeks conjunctivitis in an adult.

(3) Mild, where there is very slight discharge.

In making a bacteriological examination of the cases, given in the above table, which is essential for the proper diagnosis of any case, smear preparations were made, and stained by methylene blue and Gram's method. Where there was any doubt as to the nature of the organisms, cultivations were made on agar-agar and blood serum.

Undoubtedly by far the most important and commonest organism met with in these cases is the gonococcus, the

following table showing the frequency with which it has been found by various authors :—

Name.	Cases.	Percentage with Gonococci.
Kroner	92	68·47
Haab	16	87·50
Widmark	25	76·00
V. Ammon	100	56·00
Guerola	25	100·00
Neisser	92	68·47
Andrews	122	100·00
Hirschberg	32	100·00
Kopfstein	51	58·82
Francisco	40	75·00
Chartres	100	44·00
Gonin	38	58·00
Thomin	20	70·00
Reyling	14	71·42
Cohn	553	52·98
Groenouw	40	35·00
Alt	17	52·94
S. Stephenson	71	58·67
M. S. Mayou	35	57·50
Total	1,483	63·5

The characteristics of the gonococcus need hardly be described here. Its characteristic half-moon shape, and the fact that it decolourises with Gram's method are usually sufficient evidence of its identity, but attention must be paid to both these factors, since the diplococcus intracellularis meningitidis of Weichselbaum which decolourises with Gram's method (although the organism is smaller and more elongated) may occur, as is shown by the case given below. It grows well on serum agar in small columns, which live for four or five days, and are usually dead on the 9th. If in any doubt, the fermentation test, or a cultivation on agar-agar, will usually settle the question, since the gonococcus does not usually grow on that medium, although Mr. Bayon (Pathologist to the Seamen's Hospital, Greenwich) tells me that he has obtained growths on agar-agar. Personally, I have often

obtained growths of the gonococcus on agar-agar, but the growth is always confined to the portion of the tube on which the pus has been thickly smeared ; that is to say, where there is human serum present. I have never seen original cultures off this area, and I think that this is probably the usual explanation of the growth on agar. Subcultures from agar-agar will not often grow.

L. Müller has obtained from the conjunctiva a diplococcus identical with the gonococcus (pseudogonococcus), which was innocuous. Krukenberg has been able to get cultivations of the gonococcus on gelatine and potatoes, which, on inoculation, were innocuous. It is probable, therefore, that L. Müller's coccus was an attenuated form.

C. Brons, as the result of an investigation of the three non-Gram-staining diplococci found in the conjunctiva ; namely, the gonococcus, diplococcus meningitidis intracellularis, and the micrococcus catarrhalis, comes to the following conclusions :—

1. That the three organisms are all of the same generic type.

2. That the gonococcus is the only one which produces severe ophthalmia.

3. That they can be differentiated often by their shape, and always by culture and fermentation test.

The fermentation test depends on the acid reaction which is produced by the growth of these three organisms with the various sugars ; the organism is grown in litmus broth and ascitic fluid, containing glucose, galactose, maltose, or saccharose.

Gonococcus gives acid reaction with glucose and galactose.

Meningococcus gives acid reaction with the first, but not with the last.

Micrococcus catarrhalis gives no reaction with either of them.

The agglutination test for the three bacteria is not satisfactory.

The infection of the conjunctiva with the gonococcus differs from that of the urethra, as follows :—

1. It varies very much more in severity. As I have pointed out, comparatively mild cases occur in the conjunctiva. Thus,

in three out of nineteen cases, the discharge was quite moderate in amount. This I believe to be due to the method of infection, since it has been shown that drying (as when the infection comes from soiled towels) and cold (as when the infection is by water) both decrease the virulence; a temperature of 25° C. will kill the gonococcus.

2. That a chronic conjunctivitis comparable with gleet never occurs. This latter is certainly due to the fact that an immunity is produced in the cells of the conjunctiva which does not seem to be so always in the case of the urethra.

The gonococcus can always be detected in the discharge of these cases, and is present throughout the whole course of treatment, whilst there is any discharge at all from the eyes; it is to be found even as long as 25 days after all discharge has ceased (Groenouw). The number of organisms found varies directly with the amount of the pus.

As I have shown elsewhere,[1] pyronine methylene green is one of the best double stains for organisms, which do not stain by Gram's method, especially for the gonococcus, which is very basic, and readily takes up the pyronine.

Staphylococcal infection varies enormously in its severity, just as staphylococci vary in their virulence. They were found in 20 per cent. of my cases. The staphylococcus albus, which was so frequently present in my cases (in 8 out of 9), always produces a very mild ophthalmia neonatorum, whereas the staphylococcus aureus, which was present in one of my cases, produced a moderately severe attack, whilst the case described by Axenfeld produced a severe attack with corneal complications.

Pneumococcal infection, which formed 2·5 per cent. of my cases, although severe, is of short duration. In one case, described by Gasparrini, perforation of the cornea took place. In my case, there was only a moderate discharge, which cleared up in two weeks under protargol, 10 per cent.

B. Coli Communis was found in 5 per cent. of my cases. Axenfeld describes this as a severe form of ophthalmia neonatorum. In one case, which I have examined, the discharge was only moderate in amount, and the cornea was not affected. In the other, the discharge was very profuse, and

[1] *Hunterian Lecture*, 1904.

there was a pseudo-membrane, but, in this case, the diagnosis was somewhat uncertain, since the bacillus died out on culture.

Diplococcus intracellularis meningitidis was found in 2·2 per cent. Fraenkel has described three cases of conjunctivitis in children with meningococcus in the discharge. The diplococcus intracellularis has also been demonstrated by Hugland, in a boy, æt. 5 months, with severe purulent ophthalmia. The following case, which has come under my observation, was due to the diplococcus intracellularis. Whether or no the original infection was due to that organism, it is impossible to say.

D. F., æt. $1\frac{9}{12}$, City of London Ophthalmic Hospital, January 16, 1907. Under Mr. P. Wells. Discharge commenced from both eyes when 4 days old. An ulcer formed on the right eye which never healed; the discharge had never ceased. On admission, large unhealed ulcer of right eye. This eye was slightly proptosed, and the chamber full of pus. The globe was evidently in a condition of panophthalmitis. January 16, 1907. The eye was enucleated. Microscopic examination of the pus showed an elongated diplococcus, which did not stain with Gram's method. The organism grew freely on agar-agar in small round colonies, and gave the fermentation test.

B. Morax-Axenfeld was found in two (5 per cent.) of my cases; in both cases it was associated with the staphylococcus albus, and, therefore, a purulent discharge was present; it had produced the typical red margin of the lid so characteristic in the adult.

The Source of Infection.—There can be no doubt that the vaginal discharge is the source of infection in almost all the cases of ophthalmia in the newly born. This fact was recognised, as early as 1750, by Quellmatz, and, since then, has been confirmed by numerous observers. B. Gibson (Manchester) was the first to inoculate pus from the eye to the urethra, thereby producing the disease, but it was not until Neisser discovered the gonococcus that anything of the actual bacteriology was known. As the bacteriology is of so much importance, it is well to know something of the nature of the organisms, etc. found in the discharge which

seems to be present, to a greater or less extent, in the majority of pregnant women.

According to Playfair (*King's College Hospital Reports*, 1897), the normal vagina is covered by stratified epithelium, very much like the skin, with the exception that there are no glands. In its healthy state, it is covered by a thin, whitish secretion, with marked acid reaction consisting of fluid with leucocytes and epithelial cells, and in it is found a bacillus, which is known, after its discoverer, as the Doderlium bacillus. By its growth, it produces lactic acid, to which the acidity of the vaginal secretion is due. This acidity is supposed to be of importance as a germicide, preventing the growth of other organisms. Although other organisms, such as the streptococcus, the staphylococcus, and the bacillus coli communis, are occasionally found, they are, as a rule, of very low virulence.

During pregnancy, the discharge becomes more acid, and, therefore, has a stronger germicidal action. This action is prevented, by the use of douches, etc., before labour, and, therefore, it is advisable to avoid their use, except in cases in which it is known that there is a pathological discharge.

By far the most common organism found in the pathological discharge of pregnant women is the gonococcus. (Oppenheimer, 27 per cent.; G. von Schaick, 26 per cent.) It must be remembered that the discharge is primarily of urethral origin, and that the vagina and cervix are infected secondarily; indeed infection of the vagina does not seem to be very common owing to the thickness of the epithelium. It is therefore important, in cases of suspected gonorrhœal infection, to wash out the vagina before labour, care being taken to protect the child's eyes from the urethral discharge, during the passage of the head through the vulva. The infectivity of the vaginal discharge may last for a considerable time, for, in two cases of which I have the notes, in which two successive children were affected by ophthalmia neonatorum, the vaginal discharge was present throughout both pregnancies, and also in the interval. In neither instance, were the second infections so severe as the first. In one of them, in which I made a bacteriological examination, the staphylococcus pyogenes albus was found in pure culture.

The Manner and Time of Infection.—Infection of the child's eyes may take place—

(1) Before and during the act of birth.

(2) Immediately after the birth of the child, during washing, etc.

(3) Some time after birth. (Secondary infection.)

1. *Before and during the Act of Birth.*—There seems to be no doubt that infection of the conjunctival sac can arise before rupture of the membranes. Rivaud, Landran, Chaucon, Strezaminski, Armaignac, have all reported cases of children born with fully developed ophthalmia neonatorum, in which the membranes had only been ruptured a short time. In Armaignac's case, three-quarters of an hour only had elapsed between the rupture of the membranes by the midwife and the birth of the child.

Parischeff (*Nagel Jahresbericht*, 1892) records a case of intra-uterine infection by the gonococcus, but the membranes had been ruptured three days before birth, so that infection may have taken place after rupture. Nieden (*Klin. M. f.*, XXIX., 1901) records a case of ophthalmia neonatorum due to the gonococcus, in which the child was born in the membranes. Dr. Cullingworth quotes (*Trans. Gyn. Soc.*, 1903), and further informs me that he has seen a case of severe ophthalmia neonatorum in an infant removed by Cæsarean section (although he cannot give the exact details).

Thus it is seen that intra-uterine infection of the eyes can take place through the membranes, or, at any rate, with such a small rupture that labour does not necessarily follow. This is further borne out by the cases of so-called congenital anterior staphyloma of the cornea, secondary to perforating ulcers during intra-uterine life, such as have been recorded by Parsons, Runte, Westhoft, etc. In Parsons' case, the staphylococcus pyogenes seems to have been the exciting cause.

I have already shown that the eyelids are separated at the fifth month, and that therefore infection can take place at that date, so that any inflammatory trouble, which may have occurred, would have had time to settle down before the birth of the child. It is only fair to say that some authors consider these cases to be an arrested or imperfect develop-

ment of the cornea, but as the cornea is a non-vascular structure, the anterior staphyloma cannot be due to any abnormal development in the blood vessels, which are commonly supposed to be the cause of most other malformations of the eye unconnected with the fœtal ocular clefts.

As a rule, at birth, the lids are tightly closed, the junction being made watertight by the fatty meibomian secretion at the margins, although Cramer (*Arch. f. Gyn.*, No. 9, 1899) has proved that they may be open. During the act of birth, the discharge from the cervix and vagina may enter the eyes of the child; this is especially possible in the cases in which, from pressure, the upper lid overlaps the lower. The vaginal discharge may be carried into the eyes by forceps, or, in the case of face presentation, by the finger of the accoucheur. According to Mules, the discharge is liable to be carried into the eyes by the tightly stretched perineum.

Infection from the fæces by the bacillus coli communis is rare. In most instances, it is probably due to the vaginal or urethral discharge, but may also perhaps originate from the fæces, since the bowels are often loose during labour. This probably occurred in one case which I examined; the child was a breech presentation, and therefore more liable to contamination by the fæces; there was no history of vaginal discharge during the pregnancy.

2. *Immediately after Birth.*—Probably the most frequent time, at which infection takes place, is during the washing of the infant, some of the secretion being carried into the eyes. It is, therefore, of the utmost importance to wipe the eyelids free of secretion, directly the head is born, and to wash out the conjunctival sac with perchloride, and instil nitrate of silver immediately after the birth of the child.

3. *Infection some time after birth* is usually known as "secondary infection," and may take place from want of cleanliness on the part of the midwife, from the diapers, etc.

The absence of lachrymal secretion in the new-born child no doubt renders it more prone to infection, since there are no tears to wash away anything present in the conjunctival sac.

The Incubation Period.—According to Piringer, the length of time of incubation has a definite relation to the severity of the attack, it being more acute the shorter the incubation

period. (This can only be true for birth infection and secondary infection.) The incubation period for the gonococcus is from one to three days. Cases, therefore, occurring after the third day, may be regarded as cases of secondary infection, and due to negligence on the part of the nurse, and not on the part of the medical attendant.

The following table gives the date of onset in 174 cases in Moorfields clinics. Of these, 75·49 per cent. of the cases occurred in the first three days.

MOORFIELDS CASES—DATE OF ONSET.

——	1902.	1903.	1904.	1905.	1906.	For the Five Years. Total.	Percentage.	
At birth -	1	0	2	2	1	6	3·4	
1 day - -	3	5	5	11	4	28	16·09	75·49
2 days -	3	11	10	8	9	41	23·3	
3 ,, - -	7	16	12	8	14	57	32·7	
4 ,, -	2	2	3	2	3	12	6·8	
5 ,, - -	0	2	1	1	1	5	2·8	
6 ,, -	0	1	0	0	1	2	1·1	
7 ,, - -	1	3	3	4	3	13	7·4	23·14
8 ,, -	0	0	0	0	1	1	·57	
9 ,, - -	1	0	1	1	0	3	1·7	
14 ,, -	0	1	3	0	0	4	2·2	
21 ,, - -	0	0	1	0	0	1	·57	
Total -	18	41	41	37	37	—	—	

Total of cases investigated for the five years = 174.

This percentage is practically the same as Mr. E. T. Collins gives in 32 cases which he has recorded. Stephenson, dividing his cases into gonorrhœal and non-gonorrhœal forms, gives 80·46 per cent. for the gonorrhœal cases in the first four days and 57·14 for the non-gonorrhœal cases.

In 40 cases, in which I made a bacteriological examination, the following were the dates of onset:—

Days after Birth.	1.	2.	3	4.	5.	6.	7.	8.	13	14.
Gonococcus -	2	3	4	6	2	2	1	0	1	1
Staphylococcus -	2	0	1	0	2	1	0	1	0	1

Morax.—Two on 1st day.
B. Coli.—One on each 6th and 7th day.
Pneumococcus.—One on 4th day.
B. intracellularis.—One on 4th day.

That is to say, 66·6 of the gonorrhœal cases appeared in the first four days, and also 50 per cent. of the non-gonorrhœal cases.

As a rule, infection takes place in both eyes simultaneously, but occasionally one only is affected, or one eye several days before the other, showing that one has been secondarily infected from the other. This occurred 29 times in 326 cases, or 8·8 per cent. Kroner 6 in 63 cases, or 9·5 per cent. Groenouw 3 in 41 cases, or 7·3 per cent. Harman, in examining the records of the Belgrave Hospital, found, out of 10 cases, that the left eye was affected in 9, which he attributed to the child being usually born in the left occipito anterior position of the head, when the left eye would be towards the bed, and so be more likely to be infected.

The following table fails to uphold these results, which I can only think are due to coincidence. Thus in 29 unilateral cases, 16 were in the right eye, and 13 in the left

D.N.—Affecting One Eye at least Three Days after the First.					One Eye only affected.		
———	Total No. of Cases.	Cases.	Right.	Left.	Cases.	Right.	Left.
Moorfields :							
1902 - - -	48	4	2	2	2	2	0
1903 - - -	52	2	1	1	1	1	0
1904 - - -	50	4	4	0	2	2	0
1905 - - -	72	2	1	1	2	1	1
1906 - - -	47	4	0	4	0	0	0
Total - -	269	16	8	8	7	6	1
Percentage - -	0	5·9	2·9	2·9	2·6	2·2	·37
Central London Ophthalmic Hospital (1904–1906).	57	2	0	2	4	2	2
Total (both Hospitals).	326	18	8	10	11	8	3

Four cases confined to one eye, in which I made a bacteriological examination, were all due to the gonococcus.

(*To be continued.*)

THE CONTRACTED WHITE KIDNEY.[1]

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I AM bringing this subject before your notice to-day, not on account of its originality, but because I believe that the medical profession, taken as a whole, does not realise the frequency, or the fatality of the disease.

It is a chronic form of Bright's disease, occurring in people under thirty years of age, and not giving rise to œdema. The complaint appears to be equally common in men and women. It occurs chiefly in young adults, between the ages of twenty and thirty-five years, but usually in those under thirty.

In 1897, Dr. Leonard Guthrie published a paper dealing with seven cases of chronic interstitial nephritis, between the ages of five and fourteen years. The symptoms, which he enumerated, are those of contracted white kidney, with the exception of the amount of albumen in the urine. He says that "the amount of albumen in the urine is usually small, not so great as in chronic parenchymatous nephritis," but in no case does he give the estimated percentage amount.

Dr. W. H. Barlow, in 1874, published the case of a girl of five, who died from chronic interstitial nephritis, with small kidneys, but he does not describe them as being pale in colour. It is to Dr. Rose Bradford that we are indebted for some very concise articles dealing with the subject; and the condition is often described as "Rose Bradford's kidney."

Chronic Bright's disease may be divided, morphologically, into two classes:—

1. Large white kidney.
2. Contracted white kidney.

The red granular kidney which occurs, as a rule, in people over forty years, I shall not include under the heading of Bright's disease.

Let me first draw your attention to the picture of a typical case of chronic tubal, or parenchymatous nephritis, in order

[1] A paper read before the South Midland Branch of the B.M.A.

that the contrast with the contracted white kidney may be brought out more vividly. In chronic tubal nephritis, the patient may be a child or an adult, who has usually had acute nephritis. There is general anasarca with effusion into the serous cavities. The urine is scanty, of high specific gravity, and loaded with albumen. Pleurisy, pericarditis, pneumonia, œdema of the lungs, sloughing or inflammation of the integuments, are frequent complications, and often lead to a fatal termination.

In the second form, associated with contracted white kidney, the disease is very insidious. The patient may be free from symptoms and imagine himself in good health, until carried off suddenly by acute uræmia. With this variety, there are marked nutritional changes and great emaciation. The wasting may be so severe as to be comparable with that of malignant disease, the similarity becoming more marked, owing to the anæmia which is also present. A progressive weakness, leading to inability to work, is sometimes the symptom for which medical advice is first sought. Deep pigmentation of the skin is of frequent occurrence, and has led to a confusion with Addison's disease. The mucous membranes, however, so far as I am aware, do not become pigmented, as in Addison's disease, and the pulse tension is high rather than low.

As in other forms of Bright's disease, cardio-vascular changes are common. The heart is, as a rule, hypertrophied, the apex beat being displaced downwards and outwards, and the impulse is heaving in character. The arteries are thickened and fibrous, and the arterial tension is higher than normal. Taken as a whole, I should say that the cardio-vascular changes are, clinically, much more marked in this form of Bright's disease than in chronic tubal nephritis, but not so obvious as in many cases of chronic red granular kidney.

Headache is troublesome, very common, and is usually frontal, or occipital. The severity of this symptom may be so great as to suggest intra-cranial tumour.

The urine is not scanty, and, in the majority of cases, there is polyuria. It is pale in colour, acid in reaction, and of low specific gravity, 1004 to 1010. Albumen is present in considerable quantity, and, on boiling, the urine may give a deposit of $\frac{1}{4}$ or $\frac{1}{2}$. Since there is polyuria, the amount of albumen

excreted in twenty-four hours may be more than in the case of chronic tubal nephritis, although the percentage quantity in the urine is less. It is very rare, indeed, for albumen to be entirely absent from the urine.

Bleeding from the mucous membranes is not an infrequent symptom. Profuse hæmaturia and hæmatemesis have been recorded. In one of the cases under my care, there was persistent bleeding from the gums and nose, which was difficult to control, owing to its being a general oozing from the mucous membranes.

Ocular changes are very frequent in this form of Bright's disease, and changes in the fundus oculi should always be looked for when it is suspected. One of my patients sought advice for failure of vision, and it was only, after examining the urine and fundus, that the true nature of his complaint was discovered. The changes which occur are neuritis, retinitis, and retinal hæmorrhages. In not one of the seven cases which I have observed have I failed to find marked changes in the fundus. In three of the cases, I have been fortunate in obtaining the expert opinion of my colleague, Mr. Harries Jones. Ophthalmologists have, up to the present, regarded chronic granular kidney as the commonest cause of neuro-retinitis, and it has been estimated that about 25 per cent. of such cases present fundus changes. It is quite probable, however, when they recognise the contracted white kidney as a pathological entity, that their statistics will place this latter form of disease high above the other as a cause of ocular changes. The most serious of complications of this complaint is uræmia, which very frequently leads to the fatal termination. Usually, the patient has sought advice for failure of health previous to the onset of uræmic symptoms, but, on the other hand, it has happened that a young adult, in apparently normal health, has been seized with fits of an epileptiform nature, and died within a few days of the onset. The uræmia may be of an acute fulminating type, passing into coma from which there is no recovery, but other forms occur, such as maniacal frenzy and sudden asthmatical dyspnœa. The uræmic symptoms may be more chronic, and last for weeks, as in my patient, who had bleeding from the gums. In his case, there were vomiting, headache, and twitchings lasting

for a fortnight, followed by gradual coma in which he died. In acute nephritis, in a large percentage of cases, the uræmic symptoms pass off, and the patient returns to health again. In chronic tubal nephritis, also, we find uræmia passing off, to return again, perhaps after months or years. With contracted white kidney, however, whence once uræmia comes on, we must apprehend an immediate fatal termination.

As regards cerebral hæmorrhage, which is such a frequent cause of death in chronic granular kidney, I have not met with a case, nor have I seen it quoted in the literature. This would appear to be one form of difference between these two forms of kidney disease. Dr. Rose Bradford asserts that inflammation of the serous membranes occurs, but, up to the present, I have not met with this complication. Œdema, as we see it in acute and chronic parenchymatous nephritis, does not occur, but in cases in which the heart becomes dilated, owing to continued high arterial tension, anasarca may supervene from backward pressure in the veins. With such a failing heart, the character of the pulse is likely to change from high tension to low tension with accelerated rate. To briefly recapitulate the salient points in the symptomatology, we must remember that the disease occurs in young adults, and is markedly latent. Polyuria with much albumen, absence of œdema, cardio-vascular and fundus oculi changes, with a fatal termination from acute uræmia, completes the story.

The kidneys, as found post-mortem, may be about the normal size, but are usually much smaller, and may even weigh as little as 1½ oz. (Rose Bradford.)

The capsule readily strips or may be slightly adherent in places, and is more fibrous than normal.

In colour, the kidneys are pale and quite different in hue from the red granular kidney. It is only by comparison that they have received the appellation of "white"; mottled yellowish-pink would apply more nearly to their colour, which, however, is liable to vary with the amount of blood, which they contain at the time of examination. The surface after decapsulation is granular. The granules consist of small low-lying bosses, but are much larger than the sandy granulation of the red granular kidney. On section, the cortex is

narrow, perhaps only $\frac{1}{8}$ inch. In consists of lighter and darker patches. The medulla shows up darker than the cortex, and may appear large by comparison.

Microscopically, the tubules do not at first sight appear so numerous as in the normal kidney. They greatly vary in size some being dilated, others small. Between the tubules, and distributed more or less evenly throughout, is an abnormal amount of fibrous tissue. The even distribution of the fibrous tissue, in this form of kidney, differs from its irregularity in the red granular kidney. In many tubules, the epithelium is partially shedded, and there are granular remains lying in the lumen. Sometimes the whole lumen is packed with shedded epithelial cells, but many tubules are entirely destitute of epithelium, and are shrivelled up, the walls in consequence falling together. The glomerular tufts, in nearly all cases, are much altered by fibrous tissue, and Bowman's capsule is greatly thickened by the same material. The arteries are markedly thickened, and have much fibrous tissue in their coats, but the change is not so great as in the red granular kidney.

As regards the diagnosis of this disease, confusion may, for a time, arise. The headache, lassitude, and anæmia, in young women, may suggest chlorosis, which, however, is discountenanced by the albuminuria.

Cerebral tumours may be very closely simulated by the severe headache associated with optic neuritis. Retinitis and retinal hæmorrhages, in conjunction with polyuria and albuminuria, will then aid us in drawing the right conclusion. The pigmentation, when marked, may closely resemble Addison's disease, but, so far as I know, does not occur on the mucous membranes. In Addison's disease, the pulse tension is low, and fainting fits are common. With contracted white kidney, the tension is increased, and fits, if they occur, are likely to be uræmic; and again there will be albuminuria. When a patient is seen for the first time in uræmic convulsions, or uræmic coma, with no previous history of illness, there may arise a suspicion of poison, meningitis, or diabetic coma, all of which by careful and systematic examination can be put out of court. In fact, if the urine and fundus oculi are examined in all doubtful

cases, we are not likely to overlook cases of contracted white kidney.

The causes of this variety of Bright's disease are not at all evident. Most of the older text-books, and, in truth, some of the more recent ones, describe the contracted pale kidney as being a late stage of the large white kidney. If, however, we pause to consider, this hypothesis is not very likely to be true. In the first place, Bright's disease, associated with large white kidney, invariably, at some stage, gives rise to œdema; so that if the contracted white kidney is a later development of that condition, we should in all cases expect a history of previous œdema or ascites. As we do not get any such history in the majority of cases, this theory must be passed over. Again, many cases of chronic tubal nephritis, which live for years, are found, after death, to have large white kidneys.

Scarlet fever and other acute infections do not hold the same relation to this disease as they do to chronic tubal nephritis and acute Bright's disease. It is true that some of the cases have had scarlet fever and possibly scarlatinal nephritis, but, in the majority of cases, no such history can be obtained.

The similarity between this and red granulated kidney has led some authorities to look upon the two as being the same disease.

There are, however, certain clinical and pathological differences. In the first place, the age is, usually, in the one under thirty, in the other over forty. Alcohol and gout, which often appear to be important factors in the causation of red granular kidney, play no part in this disease. The amount of albuminuria in the one is considerable, in the other minute, or often absent. It has been stated that the greater amount of albumen in contracted white kidney is due to acute tubal changes in the red granular kidney; cases, however, of contracted white kidney, which have died suddenly from acute uræmia, have shown no acute tubal changes. Death from cerebral hæmorrhage is common in red granular kidney, but rare in contracted white kidney. I have already referred to the frequency of changes in the fundus oculi in the two diseases. Another and last point of difference is, that some

young adult cases, in which the contracted white kidney has been most evident post-mortem, have shown only slight arterial and cardiac changes. In red granular kidney, when the kidney changes are marked, the cardio-vascular changes are, with rare exceptions, very extensive. (Rose Bradford.)

Lead has been a factor in the causation of some cases of contracted white kidney, but it is not accountable for more than a very small percentage. It would seem only to be a predisposing cause. The problem, as to what is really the true cause of the disease, presents many difficulties. The fact that few patients give any history of previous illness is against acute specific fever as the original cause. Those, who have previously had scarlet fever, are not more in number than the incidence of that fever throughout the country would lead one to expect. The insidious onset of the symptoms and the advanced and chronic state of the renal changes, after an apparently short illness, suggest to me a prolonged action of some not very potent poison. By this I mean a poison, which is not in itself enough to give rise to constitutional symptoms. The poison may arise locally in the kidneys, or be distributed universally over the whole body, but having a local action on the kidneys. The local renal origin is unlikely, for such a condition would, at least occasionally, be unilateral or more marked on one side than the other, a condition which does not exist in contracted white kidney.

More probable is it that the toxic substance arises in the alimentary canal from chemical changes of the food brought about by ferments or bacteria. Possibly some portion of the tissue metabolism may be perverted, or incomplete, giving rise to an abnormal product. Admission to the blood stream ensures carriage to all parts of the body. The kidneys being the organs, which are called upon to excrete the waste products of metabolism and other substances nocuous to the welfare of the body, it is obvious that any toxic substance, whatever its origin, must come into very close relationship with the renal structures. Indeed, if we believe that the urine is secreted, rather than excreted, by the kidneys, we must allow that the toxin takes an intimate part in the life history of the individual cells. The result is a chronic inflam-

matory condition of the renal epithelium and interstitial tissue with the formation of excess of fibrous tissue.

Treatment is of little avail in staying the progress of this disease. Until we know the cause, or causes, which give rise to it, there is little hope of preventing the certain fatal termination. The latency of the symptoms is such a marked feature that, when a patient is first seen, the disease is well advanced. One case, which had optic neuritis and retinitis with severe headache, I treated with hot-air baths on alternate days, giving nitrite of soda in 3 grain doses three times a day. The headaches disappeared, and the optic neuritis cleared up, but there was no change in the retinitis. The patient returned to work, but has again relapsed.

Iron should be given in an easily assimilable form, on account of anæmia, which is always present. The clothing should be warm and chills avoided. Diuretics are of no value, but a free daily action of the bowels tends to decrease the severity of the headache.

I should like to acknowledge my indebtedness to Dr. Rose Bradford, who kindly gave me the references to his writings on this subject: and to those, who are interested in the subject, I can strongly recommend the perusal of his Croonian Lectures of 1904.

REVIEW OF TROPICAL DISEASES.

By R. TANNER HEWLETT, M.D., F.R.C.P., D.P.H.,
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SINCE the last review was written (October, 1906) the issue of a new journal devoted to tropical diseases (*The Annals of Tropical Medicine and Parasitology*) has been commenced by the Liverpool School of Tropical Medicine. This is to take the place of the memoirs hitherto published separately, and, judging by the parts already issued, it will form a valuable contribution to this branch of medical research.

A society for the study of tropical medicine has also been formed. The multiplication of societies is to be deprecated, and, at the present juncture, when the London societies have amalgamated into the Royal Society of Medicine, the formation of this new society seems unfortunate. Let us hope that before long it will become a section of the Royal Society of Medicine.

MALARIA.

Craig, in a long paper,[1] discusses latent and recurrent malarial infection, and the significance of intra-corpuscular conjugation in the malarial plasmodium. By latent infection, he means one in which the parasites may be demonstrated in the blood, but in which no clinical symptoms of the acute disease are manifested; there may or may not have been acute malarial attacks. This condition was present in 424 out of the 1,653 cases investigated, or a little over 25 per cent. By recurrent infection, he means the recurrent appearance of symptoms, due to the same group of parasites that caused the original infection. Craig, in 1905, and previously Ewing also, noted a process in which conjugation occurs within the corpuscles. Craig describes this as taking place in three stages; (1) two young hyaline rings are seen to be in contact, and careful examination demonstrates that at the point of contact there is a union of the protoplasm of the two; the process of conjugation is completed before the formation of pigment;

[1] *Journ. of Infectious Diseases*, Vol. IV., 1907, p. 108.

(2) in the second stage there is complete protoplasmic union, with the formation of a ring-shaped organism slightly larger than either of the two original parasites, and containing two chromatic masses; (3) the third stage consists in the union of the chromatin masses, and completes the conjugation of the two parasites. To this intra-corpuscular conjugation, Craig would ascribe an important rôle, viz. :—

1. It is the chief cause of the maintenance of malarial infection.

2. It maintains the infection by producing a resting, or zygote stage, of the plasmodium within the human body and other injurious influences, which is resistant to quinine.

3. It is the cause of latency and recurrence of the infection, the zygote stage remaining dormant, or latent until conditions are favourable, when it gives rise to young plasmodia, thus causing the recurrence.

Craig bases his conclusions on the following considerations :—

1. The process occurs in all acute and recent infections.

2. In other protozoa, a sexual conjugation occupies a period, during which many generations of the organism could have been produced by division or sporulation in the usual manner.

3. Such a resting or zygote stage must exist.

4. In cases, treated at once with a sufficiency of quinine, intra-corpuscular conjugation is never seen, and such cases never, or rarely, relapse.

5. The presence of numerous large pigmented bodies in the blood in cases in which the process is most marked, both intra- and extra-cellular, and which are not seen in cases in which the process is absent.

Castellani[1] details observations on cases of fever lasting from two to four weeks, and frequently confounded with typhoid and malaria in the tropics. From three such cases, a bacillus was isolated which was non-motile, formed a pellicle on broth, slowly acidified and curdled milk, produced acid but no gas in glucose, had no action on lactose, saccharose, mannite, dulcite, and formed no indol. In the fourth case, a somewhat different bacillus was isolated, as it formed indol, and produced acid from all the sugars. Rogers has also described a "7-days fever" apparently bacterial in nature.

[1] *Journ. of Hygiene*, VII., No. 1, 1907, p. 1.

TRYPANOSOMES AND OTHER FLAGELLATES. SLEEPING SICKNESS.

Minchin, Gray, and Tulloch[1] investigated the question whether the *Trypanosoma gambiense* of sleeping sickness passes through a developmental cycle in the tsetse fly *Glossina palpalis*, which transmits the disease. In no case were the flies found to be infective for a longer period than 48 hours after they had fed on infected material, and conclusive evidence was obtained of direct mechanical transference by the infected proboscis. Attempts to infect experimental animals by direct inoculation of trypanosomes from the intestine of the fly proved futile, so that the conclusion must be arrived at that infection in sleeping sickness is a direct mechanical transference. In the flies, the trypanosomes flourish, and multiply for the first 24 hours, and become differentiated into two distinct types, slender, transparent, active "male" forms, and more bulky, granular, sluggish "female" forms. Up to 48 hours, multiplication continues, and an "indifferent" type of individual appears. At 72 hours, the trypanosomes have greatly diminished, and, by 96 hours, have disappeared.

Incidentally, it was noticed that two "wild" species of trypanosomes inhabit this tsetse fly. One, the *T. grayi*, has a relatively large, elongated, micro-nucleus situated in front of the nucleus, the other, *T. tullochii*, is very active, and more like *T. gambiense*, as the small rounded micro-nucleus is placed well behind the nucleus. Minchin has found that the *T. grayi* becomes encysted in the hind-gut of the fly, and he suggests that the cysts are destined to be cast out, preparatory to infect fresh hosts. This is an unsuspected mode of infection by trypanosomes.

In 1905, Plimmer published a note[2] on the effects produced on rats by the trypanosomata of Gambia fever (trypanosomiasis) and of sleeping sickness, from which he surmised that these two organisms might be distinct. A further large series of experiments and observations[3] go to show, however, that each of these two strains of trypanosomata has produced two different effects in the same class of animals, under conditions of

[1] *Proc. Roy. Soc. Lond.*, 1906; and *Nature*, November 15, 1906, p. 56.

[2] *Proc. Roy. Soc. Lond.*, Vol. 74.

[3] *Ib.*, B. Vol. 79.

which we at present know nothing; and that these effects are alike for the two organisms; and that the trypanosomata, found in these two types of disease, are one and the same organism, modified by passage from man through monkeys to rats, and perhaps in the strains used, by transplantation into animals of, and in another country.

The observations of Schaudinn, on the supposed transformation of a bird trypanosome into spirochæte-like bodies, and of *halteridium* into a trypansome in the stomach of *culex pipiens*, attracted much attention, and various observers attempted to confirm these observations. It was soon found, however, that mosquitoes frequently contain flagellate and other protozoa as natural parasites, and, unless these can be excluded, their presence naturally vitiates work of this sort. Novy, MacNeal, and Torrey have made an elaborate investigation of the trypanosomes and other flagellates of mosquitoes and other insects, and summarises their observations as follows[1]:—

1. Of "wild" mosquitoes examined, 15 per cent. and 5 per cent. respectively, in two years, were found to be infected with flagellates belonging to two groups, *crithidia* and *herpetomonas*.

2. The *Tr. noctuæ* of Schaudinn presents the mixed characteristics of *crithdia* and *herpetomonas*, while that of Sergent agrees with the latter, and does not represent a stage of *halteridium*.

3. Trypanosomes, which are at times present in ticks, are not developmental forms of *piroplasma*.

4. The possibility of the trypanosomes of birds, and other vertebrates developing in the gut of insects, while not excluded, has not been demonstrated.

Atoxyl has proved to be a most valuable drug in the treatment of trypanosomiasis. It can be administered by the mouth, but subcutaneous or intravenous injection is preferable. The method of making up the solution of the drug was detailed in THE PRACTITIONER. It should not be boiled for long to sterilise it, as it decomposes slowly. The substance is generally stated to be an anilide of metarsenious acid, but analyses by Moore suggest that it is a sodium salt of amido-phenyl-arsenic

[1] *Journ. of Infectious Diseases*, Vol. IV., 1907, p. 223.

acid, and Ehrlich has published analyses agreeing with this view. Moore, Nierenstein, and Todd,[1] in an experimental study of infections with trypanosomes in animals, have found that atoxyl alone is often useless, at other times that it has some, but not very pronounced, curative action. Much better results were obtained by the use of atoxyl followed by a mercury salt. The best method of administration in man seems to be to give the atoxyl in gradually increasing doses, and for a long period. If the patient is tolerant (unfortunately some appear not to tolerate any large doses of the drug), this will usually cause the disappearance of all trypanosomes from the blood, and it might then be well to try the use of mercury as suggested by Moore. The experimental test of aniline colours, in the treatment of various forms of trypanosomiasis has been extensively pursued by Ehrlich, Nicolle and Mesnil, Wenyon and others, and we may hope before long that remedies will be found for some of these scourges.

Koch[2] has been continuing his work on sleeping sickness in German East Africa and in Uganda. He has found the *Glossina palpalis* to be widely distributed in German East Africa; 228 flies were examined, and two species of trypanosomes, probably *T. grayi* and *T. tullochii*, were found in the stomachs of 39, but not the *T. gambiense*. In the Sesse Islands, 163 gland punctures were made, and trypanosomes found in 160 instances, thus confirming the work of Greig, Gray, and Todd on the value of gland puncture as a means of diagnosis. Later, 190 gland punctures were done, and the trypanosome found 184 times. Koch is steadily pursuing the atoxyl treatment, and his final reports will be awaited with interest.

PIROPLASMOSIS, HÆMOGREGARINES AND LEISHMAN-DONOVAN BODY.

Nuttall and Graham-Smith have continued their studies on canine piroplasmosis, and have published, in the *Journal of Hygiene*, details of the morphology and development of the organism. These authors particularly note that neither gametoid cells, nor flagellated forms of this parasite, have been observed.

[1] *Bio-Chemical Journal*, Vol. II., 1907, Nos. 5 and 6, p. 300.
[2] *Deutsch. med. Wochenschr.*, 1906, No. 51; 1907, No. 2.

Christophers claims to have followed the development of *P. canis* in the tick[1]; and the same observer records the occurrence of a sexual cycle of the *Leucocytozoon canis* in the tick.[2]

Patton states[3] that the Leishman-Donovan body develops in the bed-bug into flagellated forms, similar to those occurring in blood-cultivation. A most important piece of work has been done by Miyajima, who has succeeded in cultivating a bovine piroplasma in a blood medium, in which it develops into trypanosome forms.[4] The species in question occurred in Japanese cattle, and seemed to be identical with the *Piroplasma parvum* of Theiler, occurring in East Coast Fever, and, like it, not transmissible on direct inoculation. In tubes of infected blood, mixed with acidulated citrate solution (as used by Rogers for the cultivation of the Leishman-Donovan body), in blood-broth, flagellated forms were found to develop. These possessed a nucleus and blepharoplast, a long flagellum, and an undulating membrane in every respect similar to the trypanosomes. By injecting these cultures into cattle, piroplasma infection was obtained.

DENGUE FEVER.

Ashburn and Craig[5] publish an important investigation on dengue fever, an extensive outbreak of which occurred just outside Manila. No organism, protozoan or bacterial, could be detected, the disease was transmitted by the intravenous injection of infected blood, and of infected blood filtered through a porcelain filter; this last fact suggests that the causative organism may be ultra-microscopic. The blood changes in the disease are of interest; there is no anæmia, and the erythrocytes are unchanged, the polymorphonuclears are reduced to as low as 34 per cent. on the seventh day, while the lymphocytes are increased to as many as 50 per cent. on the seventh day. The facts are all against the disease originating by direct contagion, and the authors believe that it is transmitted by the mosquito, *Culex fatigans*, as formerly stated by Graham. A good account of the clinical features

[1] *Brit. Med. Journ.*, 1907, I., p. 76.
[2] *Sc. Mem. Gov. of India*, No. 28.
[3] *Ib.*, No. 27.
[4] *Philippine Journ. of Science*, May, 1907.
[5] *Philippine Journ. of Science*, May, 1907.

of the disease is given, the mortality was practically nil, and the treatment suggested is purely symptomatic.

ROCKY MOUNTAIN SPOTTED FEVER.

Ricketts[1] has re-investigated this disease, in which it may be remembered, Wilson and Chowning claimed to have discovered piroplasmata, and to have shown that it is transmitted by a tick. These observations were later discredited by Stiles, who failed altogether to find piroplasmata. Ricketts has failed to identify an organism, but he claims that he has conclusively proved that the disease is transmissible to the guinea-pig and monkey by the inoculation of the defibrinated blood of patients. The disease is transmissible from one animal to another, by means of the bite of either the male or female tick (*Dermacentor occidentalis*). The virus is present, not in the corpuscles only, but in the body fluids generally, and is not capable of being passed through a Berkefeld filter.

Kieffer[2] describes a type of relapsing fever under the name of "intermittent tick fever" occurring in Wyoming, United States of America. There is sharp fever lasting usually forty-eight hours, with a remission of forty-eight hours, and the relapses may number 3 to 7. No organism could be detected, but Kieffer believes that he has obtained undoubted evidence that it is conveyed by the bite of a tick (*Dermacentor occidentalis* (*andersoni*)).

YAWS.

Castellani[3] gives a good account of yaws. It will be remembered that this observer discovered in the yaws lesions spirochætes, very similar to those met with in syphilis, which he names the *S. pertenuis*. He has now examined 59 cases, with a positive finding of the spirochæte in 56. The finding of this spirochæte has been confirmed by Powell, Borne, and others.

An examination of the blood of several patients showed usually a decrease in the polymorphonuclear leucocytes, a considerable increase in the large mononuclears, and a slight decrease in the small mononuclears.

Castellani considers that the best treatment is the administration of large doses of potassium iodide.

[1] *Journ. of Infectious Diseases*, Vol. IV., 1907, p. 141.
[2] *Journ. Amer. Med. Assoc.*, XLVIII., 1907 (April), p. 1154.
[3] *Archiv. f. Schiffs u.-Tropen Hygiene*, 1907, January.

Powell, of Bombay, has described two cases of syphilis following on yaws, and Neisser has found that monkeys, inoculated with syphilis, can also be inoculated with yaws, so that the evidence against the syphilitic nature of yaws is accumulating.

Halberstaedter,[1] by the inoculation of apes with yaws and with syphilis, finds (1) that the appearance of the primary lesion of yaws and of syphilis is different; (2) that the local reaction after yaws inoculation is more pronounced than after syphilis inoculation; and (3) that animals, after the appearance of the yaws eruption after inoculation, are susceptible to inoculation with syphilis, and vice versâ.

MEDITERRANEAN FEVER.

The Commission appointed to study this disease has practically finished its labours, and three more parts of the Report have been issued (V., VI., VII., 1907).

In Part V., from experiments on monkeys, Staff-Surgeon Shaw, R.N., concludes that infection through the eye and nose, by means of infected dust, the possibility of infection by contact, infection through contaminated food, and infection by the urine of patients, through cutaneous lesions, have all been demonstrated. Dr. Eyre attempted to prepare an anti-serum, but the results were not encouraging. Part VI. is occupied with a report by Dr. Eyre, Major McNaught, Captain Kennedy, and Dr. Zammit, on the bacteriological and experimental investigations, which yield the conclusions that the ingestion of infected articles of food, mainly milk, is the common path of infection by *Micrococcus melitensis* in man; that the next common path of infection is by subcutaneous inoculation, during the handling of infected material, usually milk, and that more rarely infection may occur as the result of contagion, or possibly through convection by means of blood-sucking insects.

Part VII. contains the epidemiological reports. The epidemiologists are led to believe that quite 70 per cent. of the cases in man are due to the ingestion of infected goat's milk, also that the disease may be acquired through infected milk, or, less often, urine, coming in contact with breaches of the surface, and so inoculation of the disease. In their opinion, ordinary contact with the sick, conveyance of infection by

[1] *Arbeit. a. d. Kaiserlich. Gesundheitsamte*, Bd. XXVI., Pt. 1, 1907, p. 47.

biting insects, house flies, dust, drain emanations, food other than milk, and water play a very subordinate part, if any, in the propagation of Mediterranean fever in man.

Excellent results have followed preventive measures directed against the use of goat's milk in barracks and hospitals. Among the soldiers in Malta, for example, in the second half of 1905, there were 363 cases of Mediterranean fever, while, in the corresponding period of 1906, there were only 35 cases. Colonel Bruce concludes that the Commission has been successful in discovering the main source of infection in Mediterranean fever. This source is the Maltese goats, some 20,000 in number, half of which are affected by Mediterranean fever, and one-tenth are constantly passing the micrococcus in their milk. If this source of infection is removed, in all probability the fever will disappear completely from Malta.

Major Horrocks, R.A.M.C., gives notes on three cases of Mediterranean fever, occurring among the civil population of Gibraltar during 1906.[1]

The first case, a man, who stated that, being somewhat debilitated, he had been in the habit of drinking a glass of goat's milk daily, and also of partaking of cheese made from goat's milk. The second case had resided in Spain for a time, and had there been supplied with goat's milk. The serum of some of the goats was obtained, and found to give the agglutination reaction, similarly some of the milk, from which the *M. melitensis* was also obtained. The third case, the captain of a British sailing ship, returned from Malta, and was soon seized with a fever, which proved to be Mediterranean fever. He had been in the habit, when at Malta, of drinking two or three glasses of goat's milk daily.

Strachan also found that Mediterranean fever is prevalent in certain districts in South Africa, and that, in these, goat's milk is largely used.

A. Critien[2] notes that the agglutination reaction in Mediterranean fever is sometimes more marked in a 1 in 40 than in a 1 in 10 dilution. The writer of this review has also noticed this phenomenon. He concludes that a definite reaction by the microscopic method, in a dilution of 1 in 10 within 30 minutes, is confirmative of a present or past *M. melitensis* infection.

[1] *Journ. Roy. Army Med. Corps*, 1907, April, p. 426.
[2] *Journ. of Trop. Med. and Hyg.*, 1907, June 1, p 187.

Bassett-Smith has published an important investigation (which gained the Cragg's Research Prize) on the treatment of Mediterranean fever by means of a vaccine.[1] The vaccine was prepared from a freshly isolated strain of the *M. melitensis*, 10-day agar cultures were employed, the growth being scraped off and emulsified in 100 c.c. of distilled water, heated to 60° C. for half an hour, and 0·5 per cent. of carbolic added. Of this mixture, 0·5 c.c. formed the dose, and the treatment was controlled by estimations of the opsonic index. Sixty-one cases were treated, and the injections were generally given at 10-day intervals, and, for each case, they varied in number from 1 to 9. Bassett-Smith formulates the following conclusions from his observations :—

1. The vaccine treatment of Mediterranean fever appears, in a certain number of cases, to produce a beneficial effect, the severity of the symptoms being diminished, the general condition improved, and the duration of the disease curtailed.

2. The disease, being characterised by its irregular course, long latent periods, and unexpected recrudescences, is one in which the estimation of the value of any method of treatment is most difficult. Too great weight, therefore, cannot be attached to the impression mentioned above.

3. In the more acute type of case, with high fever and evidence of severe intoxication, the method appears to have a deleterious, instead of a favourable action.

The writer of this review has treated two cases of Mediterranean fever with Bassett-Smith's vaccine. The first case was of long duration, and it was not until two doses had been given that a change for the better occurred. The other case was a recent laboratory infection, and after four or five recurrences of fever a dose of vaccine was given. No more fever followed, the patient lost his muscular and joint pains, and convalescence soon followed.

HELMINTHOLOGICAL NOTES.

A. Yale Massey[2] records the occurrence of *Necator americanus*, the American variety of the "ankylostome" (determined by Leiper) at Ruwe, Congo Free State. Leiper also found this species in West Africa, Loos in the Pigmies of Central

[1] *Journ. of Hygiene*, Vol. VII., No. 1907, p. 115 (also *Journ. of Trop. Med. and Hyg.*).

[2] *Journ. Trop. Med. and Hyg.*, 1907, June 1, p. 197.

Africa, and Stephens in Burma, Madras, and Assam, so that it has a wide distribution. There are, moreover, probably two or three species of *Necator*. It has long been known that the bilharzia ova, occurring in the intestine, have lateral spines, and not terminal ones like those in the urine, and Manson suggested that the intestinal form is a species different from the urinary one. Sambon[1] now definitely asserts that the intestinal form is a distinct species, to which he gives the name of *Schistosomum mansoni*. It has a wide distribution throughout Africa and the West Indies, produces a hæmorrhagic enteritis, and never infects the urinary tract.

Last year, Ashburn and Craig described a blood filaria, in a native of the Philippines, which they considered to be a new species, and named *F. philippinensis*. They have since had the opportunity of studying four more cases, and confirm their previous observations.[2] One peculiarity, with regard to this species, is that it shows no periodicity, but is equally abundant in the peripheral blood at all hours of the day and night, and, in the five cases so far studied, the parasite produced no symptoms nor lesions. The *F. philippinensis* was found to develop in the mosquito, *Culex fatigans*, and the following is the account given of this phenomenon :—

In from 14 to 15 days, the development is complete, and the filaria has passed into the labium of the mosquito ; the sheath of the embryo is lost in the stomach, and the worm then penetrates the stomach wall, and reaches the muscles of the thorax, where most of the developmental changes occur. During this period of time, the filaria has increased in length from 0·32 millimeter to as much as 2·20 millimeters, and, in breadth, from 0·0065 to 0·02 millimeter ; it has developed a well-marked intestinal canal, divided into œsophagus and intestine, a well-defined anus, and three papillæ, which are situated at the end of the tail ; the mouth appears to be simply a circular cavity, having no distinct lips. Development, so far as the morphology of the worm indicates, appears to be complete at about the 11th day, the only changes occurring after that being a lengthening and narrowing of the filaria, which enables it to enter the labium of the mosquito.

[1] See *Journ. Trop. Med. and Hyg.*, 1907, April 1, p. 117.

[2] *Philippine Journ. of Science*, Vol. II., 1907, p. 1.

A REVIEW OF DISEASES OF THE BLOOD, AND BLOOD-FORMING ORGANS.

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I.—PATHOLOGY, SYMPTOMATOLOGY, ETC.

In the last review of the literature of blood diseases (The Practitioner, 1904, p. 517) an attempt was made to state the case, as fully as possible, of the trend of thought, which modern investigations in this group of diseases have brought about as to the nature of the various forms of disease, in which the leucocytes, by reason of certain numerical changes, play so important a part. Reference was made to the conception of the existence of a parent cell, which was capable, under conditions at present unknown to us, of developing, in one of two directions, towards the formation of red cells, or towards the formation of leucocytes (Pappenheim). This process of evolution of a simple cell along lines, which led to the development of entirely new types of cells, has hitherto been restricted to those early embryonic evolutions, which lead to the development of epi- meso- or hypoblastic layers from a common cell—the fertilised ovum. Recent research seems to show that the various cellular elements of different forms of carcinoma are also derived from a common type of cell, which differs from the more fixed cells of the body in special peculiarities of the nucleus.

The parent blood cell, referred to above, which gives rise, on the one hand, to erythrocytes, and on the other, to the various forms of leucocytes met with in the blood, appears, under various pathological conditions, to develop irregularly. Qualitatively and quantitatively, defective evolution, along the former route, leads to what is known as pernicious anæmia: we speak of diminished activity in development in the direction of the leucocyte as leucopenia, and, during the last few years, our eyes have been especially opened

to a curious excessive action, which, proceeding along leisurely lines, gives rise to the well-known chronic forms of splenomedullary or myelocytic and lymphocytic or "lymphatic" leucocythæmia. This process, however, may become relatively very rapid, and acute forms of leucocythæmia are becoming more and more recognised, so much so indeed, that, judging by the frequent reference in the literature to cases of acute leucocythæmia, it is almost permissible to believe that such cases are far from rare, a discovery which is entirely due to the growing conviction that routine examination of the blood of patients is as necessary, in doubtful cases, as an appeal to the practice of routine pulse and temperature observation.

Revolution in the nomenclature of various blood-states has advanced at a great pace, and the time-worn methods of classification of these disorders, according to the clinical or coarse pathological appearances, are yielding to a classification, the clearness of which is entirely due to the greater accuracy of microscopic observations. No doubt the different classifications and nomenclatures, used by writers in various countries, are producing, in the mind of the clinician, considerable bewilderment. Blood diseases are now differentiated according to the preponderance of this or that leucocyte, or according to the degree, in which the parent cell has developed along the leucocytic or erythrocytic route.

Chlorosis appears to be a disease which stands alone, not only in its clinical characters, but also by means of our improved knowledge regarding its pathological nature, for it appears to be not so much a deviation from the normal of the formed elements of the blood as of the plasma. Restricting our attention for the moment to variations in the formed elements of the blood, the following scheme gives an idea of the complexity of blood disease, if, in accordance with modern histological enquiry, the basis of classification is made to turn upon variations of a numerical and morphological order.

The parent blood-cell may show definite development towards the erythrocyte type of cell, and then the blood-picture of pernicious anæmia is presented, but if in addition an excessive production of lymphocytes occurs then, instead of being satisfied to connote, with variable success, a more

sombre prognosis, effort in the future must be directed towards unravelling the causes, which determine, in such a condition, the association of an erythropenia with a lymphocythæmia, a condition which has already attached to itself, at the hands of Von Leube and others, the sobriquet "leucanæmia." On the other hand, if a still greater development along the leucocytic route takes place, the diminution of red cells, by clinical usage, has attracted less attention than it deserves, so that leucocythæmia is no longer an adequately descriptive term, although it may be qualified by such descriptive titles as mixed-celled leucocythæmia (the spleno-medullary form), in which both myelocytes and lymphocytes show an excessive development, or lymphocytic leucocythæmia, or myelocytic leucocythæmia, in which one or the other of these cells preponderates: the terms myelocythæmia and lymphocythæmia have been coined to more accurately express the condition, and to the objector to such cumbrous nomenclature, it must be insisted, that so long as the differentiation of blood diseases is made to depend upon an analysis of all forms, this cumbrousness of nomenclature is essentially a logical proceeding, and we must be prepared, in the future, for still further additions of polysyllabic qualifications, one very much needed being a word which will express an increase of polymorphonuclear cells, for "leucocytosis," as the foreign literature frequently shows, is, with much distress assuredly to both native and foreign readers, as much used to express a total increase of leucocytes as a whole, and of the particular cell, which is known as the polymorphonuclear cell. Again, to express accurately adequate terms, in conformity with the new nomenclature in what is known as "spleno-medullary leucocythæmia," the term myelolymphocythæmia must be accepted as an ungainly but necessary evil. Fortunately, we need not fear the introduction of "myelopenia," because myelocytes do not occur in the blood in health, at any rate in adults, but we must not be surprised to meet homologous terms to represent a blood-state, in which the polymorphonuclear cells, basophile or eosinophile cells are absent or reduced, and already we know of terms, which express an excessive development of the latter two cells, and this necessity has permitted such in the form of basophilia and eosinophilia.

How very necessary it is for our text-books to discard the use of the terms "spleno-medullary" and "lymphatic" leucocythæmia is shown by the now well-authenticated occurrence of the former malady with a blood-picture, which is aptly met by the term myelocythæmia, or myelæmia in some cases, and yet, in others, by the term lymphocythæmia or lymphæmia, and further by the knowledge that the blood may be loaded with myelocytes without the occurrence, clinically, of enlargement of the spleen, or even of the lymphatic glands, and also of the existence of cases, in which the blood is loaded with lymphocytes, without the occurrence of any glandular enlargement, but with a splenic enlargement of such magnitude, that it reached the pubes, as happened in a case the observation of which Sir Thomas Barlow kindly allowed me to share. In the face of such apparent anomalies, as judged by the other clinical formularies, we must, without further delay, accept the inevitable, and make the microscope the arbiter alone in the scientific denomination of blood diseases of this kind, when they come under clinical observation.

Unfortunately, from the point of view of pure pathology, apart from clinical requirements, it must be admitted that hæmatological studies fall far short of providing an adequate estimate of processes, whose inception takes place in such clinically remote tissues, as the marrow, spleen, and lymphatic glands and nodules. Such matrices as these may be undergoing fundamental changes; their interstices may be packed so full with metaplasic departures from the type of cell, usually resident therein, as to lead to grave enlargement or alteration, and yet the blood, for reasons which are still quite obscure, fails to reflect, in the slightest, or only in equivocal, degree, any departure from the normal; finally some of these tissues may undergo a "retroplasic" change to the simplest architecture, whilst others are revealing active metaplasia of their contained parent blood-cells, with the result that the lymphatic glands and spleen, for example, may show changes characteristic of leucocythæmia, the blood too may be quite typical, and yet the marrow may fail to show any changes whatever, or at best an aplastic transformation. With this brief but necessary comment, it is easier for a reviewer to approach some, at least, of the important problems, which beset a department of patho-

logical and clinical inquiry, which has so little in common with other better known and appreciated spheres.

Polycythæmia.—This term has been introduced to indicate a new form of disease of the blood and blood-forming organs, the first recognition of which, in this country, is due to Saundby and Russell, though to Vaquez priority should be given, and even to Rendu and Widal before the latter writer. According to Glaessner (*Wien. klin. Woch.*, 1906, s. 1475), the number of reports on this disease, which he was able to collect to date, was about thirty. It is a misfortune that subsequent writers have continued to use a composite clinical nomenclature in order to describe this disease, such, for example, as polycythæmia with cyanosis and splenomegaly, for, just as in the leucocythæmias, we are learning, rather late in the day, to discard clinical definitions in favour of pathological ones, so too in polycythæmia, it is already evident that cyanosis, enlargement of the spleen, and increase of the red cells, independent of cardiac or other known disease, are not so constantly associated as to warrant that only these cases should be regarded as examples of the disease, in which all three clinical signs are present. Parkes Weber (*Lancet*, 1905, I., p. 1254) has described one of these cases. He found that the red cells varied from 8,240,000 to 10,960,000 per cubic millimetre, the leucocytes from 4.000 to 8,000, the spleen was moderately enlarged, but there was no cyanosis, recalling a similar observation by Zaudey (quoted by Glaessner *l.c.*), in which also cyanosis was absent. Parkes Weber's case is, in other particulars, so similar to other cases previously described, that there can be no doubt but that it should be included in the category of disorders, which have come to be known as examples of "la maladie de Vaquez." Cyanosis is not, therefore, an essential feature, and Vaquez and Widal almost think that it is of accidental occurrence; nor apparently is enlargement of the spleen a constant manifestation, for Kikuchi (*Prager mediz. Woch.*, 1904, s. 491) describes cases, in which splenomegaly is absent, and a similar observation has been made by Pfeiffer (*Deut. Arch. f. klin. Med.*, Bd. XC., s. 609). Despite the maintenance by Türk (*Wien. klin. Woch.*, 1904, s. 153) that all three cardinal features of the disease should be present before the diagnosis is made, there can be little doubt the clinician must be prepared to meet with cases, probably in

their earlier stages, in which the change in the blood picture is the only one present. The tendency to look upon the change in the red corpuscles as the one element, which is constant, is shown by the tendency of various writers to describe their cases under the simple title of polycythæmia, or "polyglobulie" (Schneider, *Wien. klin. Woch.*, 1907, No. 14, s. 413): splenomegaly is probably as little characteristic of the disease as it is of myelocythæmia. Until more knowledge is obtained as to the exact causation, which underlies the changes met with in the marrow, blood, and other tissues, and which results in the development of an excessive number of red corpuscles, or of leucocytes, it would almost seem better to bring the nomenclature of this new disease into line with that adopted to describe an increase of the various forms of leucocytes, and to call it polycythæmia rubra, erythrocytosis, or, better still, erythrocythæmia, without affixing the term "megalosplenica," which has been suggested by Senator (*Zeitschr. f. klin. Med.*, 1906, B. LX., s. 357).

This last addition to the group of blood diseases, characterised by increase in the number of red cells, completes what appeared to be an unfinished part of the scheme of the histological study of the blood; for now, besides leucocythæmia and leucopenia, there is erythrocythæmia, and probably erythropenia will serve almost as well to describe the well-known condition—pernicious anæmia. The problem, which now lies before us, is to discover the mechanism by which an excessive or depressed development of the red or white cells is brought about. So far it is quite unsolved, and we must be content to define, on clinical grounds, when studies of a pathogenetic order fail us. Reckzeh (*Zeitschr. f. klin. Med.*, 1905, Bd. LVII., s. 215), in a review of twenty-nine observations of polyerythæmia, sketches the chief features, and reviews all the known theories of causation. It appears to begin in middle life, and affects men and women equally. Development is slow, and may be shown at first by hæmorrhages from the œsophagus and stomach, by headache, giddiness, weakness, and disturbances of the alimentary tract. The cyanosis is marked in the extremities and in the mucous membranes, and is not infrequently accompanied by dilatation of the small veins. Arterio-sclerosis and rise of blood pressure have been noticed; the splenic enlargement

may be of variable degree, and, as it has been seen, may be absent; the erythrocythæmia amounts, on an average, to 10,000,000 per cubic millimetre; the white cells are not usually increased; the course of the disease is very slow and variable; cure has not been observed. Treatment is unsatisfactory, and consists in the use of quinine, and a dietary poor in iron; splenectomy and treatment by Röntgen rays are on their trial, but so far are not encouraged by good results. The various views of the causation of the disease are that it depends upon tuberculosis of the spleen, upon failure of the action of the spleen, and upon disease of the erythroblastic tissues of the marrow. Reckzeh concludes, from his experiments of ligature of the large veins entering the heart, that it is due to obstruction of the venous system, for he was able to produce, by this means, an increase of the red corpuscles, and also cyanosis; he failed, however, to produce enlargement of the spleen. Cheinisse (*Sem. Méd.*, 1906, No. 35, p. 409) also calls attention to the fact that cyanosis as such is not a necessity, for the colour may be purple-red, occasionally the fingers are clubbed, the skin may be bronzed, and the enlargement of the spleen may precede, for a long time, the onset of the change in colour; the urine may contain albumen and casts and even an excess of urobilin; erythromelalgia may be also present.

According to Glaessner (*l. c.*), if more support is required for the diagnosis of this disease, a desire which its rather protean character necessitates, an appeal must be made post-mortem to establish the specific changes met with in the marrow.

Leucocythæmia.—The increasingly frequent occurrence in the literature of reports of various forms of leucocythæmia shows what great attention this subject attracts from clinical and histological points of view. Observers seem to be largely concerned in pointing out how this or that case serves to fill up the hiatuses, which have existed in a sketch-plan of blood diseases, based on the assumption that the bed-rock of blood-alteration is an excessive, diminished, or distorted metaplasia of a parent cell. Pappenheim (*Zeitschr. f. klin. Med.*, 1904. Bd. LII., s. 257 u. 407) considers that the matrix, which is the seat of the further development of the parent cell of the leucocyte, is the marrow, even if it must be admitted,

as noted in the former review, that this characteristic is shared by other tissues, such as the spleen and lymphatic glands, though in a less degree. Clinically, there may be a great increase of myelocytes in the blood, but there may be no evidence of involvement of the spleen or lymphatic glands. There are other forms of leucocythæmia, in which the changes, initiated in the marrow, may affect the system, producing mixed forms of leucocythæmia, in which the spleen alone, or the lymphatic glands alone, or both appear to be involved. Pappenheim makes a subdivision of leucocythæmia, according to histological evidence, which, as already stated, marks the real progress in the study of blood diseases of the last few years, in the appeal to the microscope rather than to bedside evidence only.

Group I.—Lymphocytic leucocythæmia which includes:—

a. Conditions, in which there is an excess of small lymphocytes in the blood (the familiar "chronic lymphatic or lymphocytic leucocythæmia").

b. Conditions, in which the large lymphocytes preponderate (the less frequent so-called "acute leucocythæmia").

c. Another condition of the blood, in which, besides a preponderance of small and large lymphocytes, there exists an unusual number of the cells designated as large mononuclear leucocytes. This cell, according to the description and plates given in Pappenheim's *Atlas der menschlichen Blutzellen* (Jena, Gustav Fischer, 1905), approximates closely to what we speak of in this country as a "hyaline cell," so that to preserve the plan indicated above, the condition might be spoken of as a "hyalocythæmia." The large mononuclear cell is a large cell with a relatively small nucleus, and a large amount of cytoplasm.

Group II.—Mixed-celled leucocythæmia. Under this head Pappenheim includes those conditions, in which the salient feature of the blood picture is the preponderance of the various forms of myelocyte, as seen in the well-known "splenomedullary leucocythæmia" of the older text-books, but better indicated as myelocythæmia or myelocytic leucocythæmia.

This group includes three subdivisions :—

a. Besides the occurrence of normal cell types, there are, in addition, representatives of the erythroblasts, or nucleated red cells, of giganto-blasts, and necessarily of the mononuclear cells, known as myelocytes, possessing α, β, and ε granulations. There are also large lymphocytes. This blood-picture represents the most common variety of myelocytic leucocythæmia, and would include the so-called "mixed celled" variety.

b. The second sub-group shows a blood-picture in which practically each or all the groups of cells, possessed of a polymorphous nucleus, are suppressed, myelocytes taking their place.

c. The third group includes those cases in which the blood-picture shows the presence of one or other of the less familiar types of myelocytes, and which, therefore, may be spoken of as an example of "atypical myelocytic leucocythæmia."

This generalisation is quoted mainly to show on what lines the newer nomenclature of blood disease is being laid down, and without wishing for a moment to offer too critical a welcome to such a logical proceeding, it must be admitted that the complexity of titles will, before long, prove to be the greatest difficulties that hæmatologists have to face, for, strictly speaking, the advent of the erythroblasts in sub-group *a* of Group II. should find expression in the name as well as that of any other particular type of cell, which, as an alien, has complicated the normal blood-picture.

Nauwerck and Moritz publish a remarkable example of the first sub-group of Pappenheim's Group II. (*Deuts. Arch. f. klin. Med.*, 1905, Bd. LXXXIV., S. 558). There was enlargement of the spleen and lymphatic glands, and the blood examination showed reduction of hæmoglobin and of red cells, and a total count of 7,000 white corpuscles per cubic millimetre, the analysis of which showed 18–20 per cent. of lymphocytes, 65 per cent. of polymorphonuclear cells, and 5 per cent. of large mononuclear cells ; the myelocytes numbered 2–4 per cent., and the eosinophile cells 6–13 per cent. Besides marked myeloid hyperplasia of the marrow, and other characteristic leucocythæmic changes in the spleen, lymphatic glands, liver and kidneys, *there*

was extensive sclerosis of most of the bones. So far from the cellular proliferation of the marrow tending to produce, by their infiltration, a rarefactive change in the adjacent bones, the opposite effect had occurred. This case seems to accentuate the observation that, though leucocythæmia has so much in common with ordinary sarcomatous development, the cardinal feature of infiltration is remarkable by its absence, the bones, liver, spleen, etc., though the seat of most intense internal change, appear to have preserved their particular configuration. Only in very exceptional cases are bone pains a feature of the malady, and it is quite conceivable are, when they do occur, mere expressions of some intercurrent bacterial infection. Findlay (*Glasgow Med. Journal*, 1904, Vol. LXII., p. 81) has reported a case of chronic leucocythæmia, in which pains in the bones were a marked feature.

It is strongly contended, by some writers, that the formation of granular leucocytes of all kinds is to be especially relegated to the marrow. As is well known, opponents of this view are numerous, and cases such as those described by Rubinstein (*Zentralbl. f. inn. Med.*, 1905, No. 8, s. 201) give strong support to the view that granulocytes may develop in tissues far removed from the marrow, and, in circumstances, which may obviously preclude the possibility of their initiation in the marrow, and subsequent dissemination in the spleen and kindred tissues. Rubinstein contends that his case was one of myeloid (or myelocytic) transformation of the spleen. There was a total count of leucocytes of 90,000–112,000 per cubic millimetre. *On no occasion during life were any myelocytes or normoblasts found in the blood-stream*, from which it may be safely argued that there was no dissemination by the blood-stream of the accredited specific cells of the marrow, which was found to consist almost entirely of neutrophile myelocytes (60 per cent.), of polymorphonuclear cells (30 per cent.), of some eosinophile cells, of a few non-granular cells, and of nucleated red cells. The spleen and lymphatic glands should, in conformity with the theory that the marrow is the sole matrix for the development of granulocytes, have been found to be quite free from myelocytes or erythroblasts, instead of which, it was found that there was a very marked myeloid change in the spleen, for it contained many polymorphonuclear leucocytes, and, in addition, true myelocytes and normoblasts; the lymphatic

glands also contained true myelocytes, though to a less degree. It is much more probable, therefore, that in pathological conditions, matrices, other than those of the marrow, are capable of producing cells, claimed by some to be exclusively of marrow origin, and it must be allowed that certain mother-cells, evident in a variety of tissues, are capable, when suitable stimuli come into play, of undergoing a metaplastic transformation to types of much more elaborate microscopic detail.

It may be thought that the numerous discussions on the nature of leucocythæmia have proved to be quite barren of practical results, and are only of interest to the histologist. It is, however, readily seen that many weighty matters underlie a correct appreciation of the meaning of leucocythæmia from the point of view of treatment. If it is true that the spleen may be the seat of a primary metaplastic formation of complex blood-cells, from an indifferent parent cell, then there is good excuse for splenectomy, for, by this means at least, a *fons et origo mali* is being attacked in part; but if the spleen, in accordance with another theory most ably supported by Professor Muir (*Glasgow Med. Journal*, 1905, Vol. LXIV., p. 161), becomes enlarged in response to increased demands for the removal from the blood of an excessive leucocytic content of the blood, then splenectomy must necessarily be unscientific. A great deal of capital has been made to support the view that the spleen is, so to speak, a filterer of the blood, abstracting its formed elements red or white cells, from the fact that the splenic vein joins the portal vein, but, quite recently, Konrad Helley (*Die Hömatopoetischen Organe*, Alfred Holder, Wien, 1906) has brought forward many histological details, which show that the spleen is a tissue, which, like that of the marrow or lymphatic glands, *contributes cellular elements to the blood*, and differs from these tissues mainly in the fact that its cellular details and scaffolding have had to be rendered special in arrangement, because the spleen is practically a lymphatic gland interposed in the blood-stream, whereas the definitive lymphatic glands of the anatomist are intercalated in the lymph stream, and the marrow, lodged, as it is, in a veritable backwater of the circulation, and protected by a bony covering, requires very little specialisation designed to prevent too free a contribution of cells to the blood.

Professor Muir (*l. c.*) also objects to the use of the terms

Hodgkin's Disease (lymphadenoma) and pseudoleukæmia as synonyms. He considers that the former malady is a disease *sui generis*, and that, though in the later stages of the malady, the sclerosed tissues may not present anything characteristic, yet, when observed at an earlier stage, features exist, distinguishing it from leucocythæmia, from its aleucocythæmic ally—pseudoleukæmia, from tuberculous adenitis, and from lymphosarcoma. Lymphadenoma is a disease characterised by a reactive effect to a chronic infection (cause unknown) of the stroma and endothelial cells.

Although the more common forms of lymphatic leucocythæmia comprise those cases, in which formative mother-cells give rise to an increase of the small or large variety of lymphocyte, it seems established, by a report of Gluzinski and Reichenstein (*Wien. klin. Woch.*, 1906, s. 336), that a form of lymphatic (*i.e.*, non-granulocytic) leucocythæmia occurs, in which the parent cells have given rise to an excessive formation of Türk's "stimulation" cells—that is, cells which Pappenheim considers to be "plasma cells." The two writers mentioned above speak of their case, as one of myeloma (there was albumen in the urine) and leucocythæmia lymphatica "plasmocellularis."

Usually, cases of acute leucocythæmia occur only in the young, but this must not be considered to exclude the occurrence of the chronic form at a tender age, Mennacher (*Münch. med. Woch.*, 1906, s. 2108) reports a case of chronic lymphocytic leucocythæmia in a child of four months. The blood picture presented the following features:—red cells, 4,900,000; white, 258,000; nucleated red cells, 20,000 per cubic millimetre; polymorphonuclear cells, 20·66 per cent; lymphocytes, 74·44 per cent.; neutrophilic cells, 4·14 per cent.; a few mastu- and eosinophile cells. A special feature present in this case, and one which has also been noticed in adults, was that, besides the enlargement of the lymphatic glands, the spleen showed an increase of size, so much so that it almost reached to the symphysis pubis.

Interesting cases of involvement of the internal ear by leucocythæmic deposits have been described by Parkes Weber, and others. Alexander (*Zeitschr. f. Heilk.*, 1906, Bd. XXVII., *Abt. f. Chir.*, s. 331) has contributed a full account of the various disorders of the ear occurring in the various forms

of acute and chronic leucocythæmia. These included acute exudative otitis media, acute and subacute catarrh of the Eustachian tubes, acute hæmorrhagic suppurative otitis media, acute hæmorrhagic mastoiditis, acute hæmorrhagic parotitis, acute inflammation of the labyrinth, acute leucocythæmic auditory neuritis, hæmorrhage into the meatus, and hæmorrhage into the middle and internal ear.

Chloroma.—It is at present not clearly settled whether this malady should be looked upon as a variety of leucocythæmia, or whether it should be considered as an independent disease. Risel (*Deuts. Arch. f. klin. Med. Abt. f. Chir.*, Bd. 72, s. 31) and Weinberger (*Zeitschr. f. Heilk.*, 1907, Bd. 28, *Inn. Med. Abtheil.*, s. 1) give a full discussion of the malady. As is well known, in addition to blood-pictures similar to those of leucocythæmia, there are identical changes met with in the marrow and lymphatic tissues, but an attempt has been made to define as true chloroma cases in which the ordinary anatomical configuration of the various organs affected is distorted and the increase of lymphocytic or myelocytic development is limited by no such rules as appear to prevail in leucocythæmia, for infiltration is a feature, so that the characters of a true malignant growth are simulated. Moreover, in chloroma, there is a curious grass-green colouration of the leucocythæmic-like tissue. Although this colouration is not common in leucocythæmia, I have records of at least one case of ordinary lymphocytic leucocythæmia, occurring in a child in which mastoiditis was simulated by a lymphocytic discharge from the middle ear, and in which, post-mortem, the abdominal and thoracic glands showed temporarily, on section, a marked green colouration. There was, however, no invasion of tissues adjacent to the lymphocytic glandular deposits. Most cases of chloroma are characterised by the presence of a lymphocythæmia, but to show that green colouration is not a special feature of this particular variety, cases have been recorded in which the predominating cells were myelocytes (*see* Weinberger, *l.c.*, Klein and Steinhaus, *Zentralbl. f. Allg. Path.*, 1904, s. 49 ; Türk before the Association of Physicians in Vienna in 1903 ; Steinberg, *Beiträge zur path. Anat.*, 1904–5, Bd. 37, s. 437). Meixner (*Wien. klin. Woch.*, 1907, No. 20, s. 593) also contributes an account of another case of what, in the absence of a

complete post-mortem examination, appears to have been one of myelocytic chloroma. It is quite true that a feature of chloroma is the infiltrating nature of the myelocytic and lymphocytic developments, but if this definition of chloroma is to be adhered to, there must be a revision of certain reports of leucocythæmia, which, according to this definition, should be called chloroma.

Hodgkin's Disease.—Longcope (*Bulletin of the Ayer Clinical Laboratory of the Pennsylvania Hospital*, 1906, No. 3, p. 86) has published an interesting account of the distribution of the eosinophilic leucocytes in a fatal case of Hodgkin's disease, with general eosinophilia. It is one of the objections to the microscopic examination of the tissues of patient suffering from chronic, and even from acute disease, that the picture secured is one which hardly represents the true state of affairs as they exist during life ; even if examinations are made shortly after what may be called the molar death of the individual, there is every probability that many of the cellular elements have been moribund for quite a long time before molar death closes the scenes.

The examination of the cell deposits in leucocythæmia, lymphadenoma, etc., reveals very often very imperfect reaction on the part of the nuclear filaments to various stains ; even the cytoplasm may fail to take up the colours. It is therefore only by making observations, such as Longcope has done, that we can possibly arrive at anything like a true picture of the histology of this disease. The patient who was the subject of his examination was suffering from lymphadenoma, and died from mechanical causes, due to the pressure of lymphadenomatous glands upon the trachea. Longcope has already given an elaborate description of the histology of a gland, removed from this patient's neck by operation, and his present paper is an important pendant to that description. Despite the observations by Pröscher and Pappenheim, which show that eosinophilia can originate locally, as when tænia extract is injected into the peritoneum of rabbits, Longcope is inclined to consider that, whenever eosinophilic cells are discovered locally, they have originated from the matrix of the marrow of the bones. In the tissues he examined after removal from the subject referred to above he was unable to discover, in the lymphadenomatous deposits, any signs of proliferation of

the eosinophile cells, as shown by mitosis. Nor apparently were mitotic figures noticeable in the marrow; but owing to the relative and absolute numbers of the eosinophiles in the marrow, Longcope considers that Ehrlich's contention is supported, that eosinophilia is an expression of stimulation of the marrow. Reference has already been made to Rubinstein's report as a disproof of this view.

Prurigo, occurring in the course of Hodgkin's disease, is well known, though the complication is rare. Dubreuilh (*Ann. de Dermat.*, 1905, p. 665) has been able to collect records of 18 cases of this so-called "prurigo lymphadénique," including his own two cases of what was either malignant lymphoma or Hodgkin's disease. It is considered that this symptom is due to toxic derivatives of the diseased glands, though the question is quite unsettled as to the nature of the toxic agent, and as to why the complication should be so rare.

Leukanæmia.—So long as the attempt to associate clinical characteristics with hæmatological pictures was, so far as the latter is concerned, restricted to a consideration either of an increase in white cells or reduction of red cells and hæmoglobin, the task was comparatively simple. Refinements naturally have followed upon this plan, and the leucocythæmias have been subdivided according to the preponderance of this or that form of myelocyte or lymphocyte, and pernicious anæmia, at one time considered to be comparatively easily differentiated by the microscope, has fallen a prey to the spirit of further refinement. Von Leube, Luce, and Parkes Weber have shown that there is a group of cases which reveals in the blood-picture the characters of both leucocythæmia and pernicious anæmia, so that it has become necessary to coin a new term—leukanæmia—to express a blood state, in which the red cells are greatly reduced in number, without being accompanied by a corresponding reduction of hæmoglobin, erythroblasts also occur, and the leucocytes show abnormal numbers, abnormal relative proportions, and usually abnormal types. Kerschensteiner (*Münch. med. Woch.*, 1905, s. 991) describes a case in which there were only 825,000 red cells per cm.m.; 16 per cent. of hæmoglobin; 5,300 white cells, and 520 erythroblasts per cm.m.; 78·3 per cent. polymorphonuclear cells, 8·6 per cent. myelocytes, 5·5 per cent. lymphocytes, 1 per cent. eosinophile cells, and 7 per cent. large mononuclear cells—a blood-picture

which may be described as that of pernicious anæmia with myelocytosis combined, in accordance with the more advanced views of the cytogenic formation of the spleen, with a myeloid transformation of this organ. The spleen, in these cases, shows enlargement usually in a marked degree. Hurter (*Liverpool Medico-Chirurgical Journal*, 1907, January, p. 108) has pointed out that similar cases have in reality been described before, although not designated by this name, and French observers have used as a descriptive term for this group "chronic splenomegaly with anæmia and myelæmia."

A possible explanation of such cases of leukanæmia is one suggested by the subsequent development of a case of pernicious anæmia, observed by Hurter, who found that, during the last few weeks of life, his patient's blood altered, until it assumed the characters of acute leucocythæmia. It would thus appear, from this remarkable case, that leukanæmia is but the expression of a transition from pernicious anæmia to leucocythæmia.

Splenic Anæmia.—Bewildering as this multiplication of diseases, according to the variation in the blood-picture, has become, still worse trouble is in store, because "splenic anæmia," includes a group of disorders which has long baffled the clinician, especially when it occurs in children, and is accompanied by leucocytosis. This disorder may be accompanied by leucocytosis, but cases are on record for which the term leucopenic splenic anæmia would be justifiable in application, for a reduction rather than an increase of leucocytes occurs, and d'Amato (*Zeitschr. f. klin. Med.* 1905, Bd. LVII., s. 233) has described a group of cases, including two of Banti's disease, two of chronic malaria, and one of syphilis of the liver and spleen, in which the splenomegaly was accompanied by leucopenia.

Stengel (*Americ. Journ. Med. Sc.*, 1904, July to December, p. 497), who is sceptical of the individuality of splenic anæmia, holding that it includes many different sorts of diseases, endeavours to show that such cases are in reality cases of pernicious anæmia, Hodgkin's disease, leucocythæmia (Triesinger's aleukæmic variety), splenomegaly with cirrhosis of the liver, hypertrophic cirrhosis of the liver, and chronic splenitis (*e.g.*, anæmia infantum pseudoleukæmia).

Springthorpe (*Intercolonial Medical Journ. of Australia*, 1904, July 20, p. 341) describes the occurrence of six cases of

splenic anæmia in one family; three sisters and a brother were affected with this disease, and the brother had a son and niece also affected. The tendency of splenomegaly to occur in families is known, but this family appears to be unique.

Pernicious Anæmia.—Despite the fact that a large number of writers prefer now to look upon this disease as an expression of perversion of the function of the bone marrow, in the sense that an essential departure has been made from the ordered development of red cells from some parent type, there is reason to believe that this point of view is a too limited one, for no reason is vouchsafed why such a curious departure from the normal should take place, and various writers, who admit much that has been said in this direction, seek to find some toxic agent, which should provoke this charge. Tallqrist (*Zeitschr. f. klin. Med.*, 1907, Bd. LXI., s. 427) refers to the remarkable discovery that in the proglottides of tape-worms, *e.g.*, bothriocephalus, there exists a lipoid substance, possessing strong hæmolytic characters, which so far has not been separated, forms no anti-toxin, is thermo-stabile and is similar in action to proteolytic ferments; experimentally employed, this substance shows distinct power of producing anæmia, although the hæmoglobin content of the red corpuscles is raised and the leucocytes remain normal or subnormal in numbers, and although a relative lymphocytosis develops. The tissues of the animals experimented upon, moreover, show changes similar to those met with in pernicious anæmia. The tape-worms, found in cases of bothriocephalus anæmia, show marked dissolution of the proglottides, and Tallqrist, although unable to explain why such changes have occurred, hazards the guess that, in cryptogenic pernicious anæmia, in which changes are frequently found in the intestinal mucosa, the source of the material, which produces the anæmia, is the mucosa which is known to yield substances which have similar hæmolysing properties to the hæmolytic agent found in tape-worms and to the lipoid substance mentioned above. Similar hæmolysing substances have been found in malignant tumours, and it is impossible to ignore the fact that, in certain cases of carcinoma, especially of the stomach, anæmia is produced which the most alert have, for a time at least, mistaken for pernicious anæmia.

The Guaiacum Test for Blood.—The guaiacum and ozonic ether test for blood has been somewhat discredited of late,

for it has been found that guaiaconic acid can be directly oxidized by pus, milk, and potato, and indirectly in the presence of hydrogen peroxide by various catalytic agents. Obviously, these facts have engendered suspicion as to the trustworthiness of the test, and some clinicians prefer to make use of the Prussian blue test, by heating, for example, stomach contents with nitric acid, and then adding potassium ferrocyanide. Such a procedure is not, however, so simple as the recourse to the guaiacum test, and Dr. Buckmaster (*Proceedings of the Physiolg. Soc.*, 1907, March 23) reminds us that the guaiacum test has great value, not only in a negative sense, but as establishing, when present, the existence of blood. The test should be carefully carried out using a *boiled* suspect. Dr. Buckmaster finds that the guaiacum reaction becomes, in these circumstances, a most delicate test for blood. He finds the reaction depends upon the rôle played by the iron of the hæmaglobin, and not on any constituent of the stroma of the red corpuscles, nor on the plasma; the iron, when split off from the hæmoglobin, acts, not merely as a carrier of oxygen to the guaiaconic acid, but as a direct oxidizing agent.

Two interesting examples of the importance of making leucocyte count in cases of pyuria are described by Talma (*Berl. klin. Woch.*, 1906, s. 705). The cases simulated so-called "cryptogenic" sepsis, or pyæmia; in both cases there was pus in the urine, no disorder of the urinary tract was detected at the post-mortem, and no focus of suppuration could be found anywhere. The second case was complicated by tuberculosis of the lungs and contracted kidney, and, at the post-mortem examination, again no focus of suppuration was established. The blood examination, during life, had shown, in both cases, an increase of leucocytes, in the first associated with a percentage of 94 of polymorphonuclear cells, and the second with one of 79. To describe these conditions, Talma suggests the term leucocytosis-pyæmia. Considering the clinical importance of pyuria as proof of suppuration in the urinary tract, these two cases are of great interest; it looks as if the blood stream alone may be the seat of suppuration, and contribute not only soluble substances, but also particular bodies to the urine without the existence of extravascular suppuration.

(*To be continued.*)

THE TREATMENT OF CHILBLAINS.

By F. GARDINER, M.D., F.R.C.S. (Edin.),
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Like many other, so-called, minor ailments, that of chilblains is too frequently treated lightly in general practice, and this neglect is often construed by a patient into a confession of failure.

Quackery is a plant which, like other weeds, grows readily on neglected soil, and one, therefore, does not wonder at the large number of nostrums which are said to cure this trouble.

I am of opinion that no case need go beyond the erythematous stage, that recurrences can be aborted, and that many cases can be cured.

It is of importance to make a thorough study of the patient's general condition, and to intelligently recognise the stage of the disease.

The two chief points in its ætiology are—

(*a*) that lesions occur at the extremities of the circulation; and

(*b*) that cold, and more especially rapid variation from heat to cold, start the lesions.

Obviously, these two factors have an interaction; the skin being more readily affected by chill where the blood supply is feeble.

The blood supply is a term which embraces several items.

1st. The blood itself may be diseased, cf. any of the various anæmias.

2nd. The arterial supply may be at fault, cf. disease of the vessel walls, muscular or vaso-motor nerve weakness.

3rd. The venous supply may be impaired, cf. various lesions causing congestion.

4th. There may be heart disease in any of its forms.

These headings include a large number of conditions, which may have, as sequelæ, a lowered vitality of the tissues from

insufficient nourishment, and combined with this, or apart, an impaired reaction to irritation. It stands to reason that local means will, in most cases, produce only a temporary improvement, when any of these general states co-exist.

The important point is that the physician should ascertain what general disease is present, and treat it *secundum artem.* I will therefore only mention a few remedies which should be given internally.

Cod-liver oil and iron almost invariably head the text-book list, and, while undoubtedly beneficial, their indiscriminate use is bad. Frequently, patients, with a liberal supply of fat, have been noticed to be taking Oleum Morrhuæ, and persons, with over 80 per cent. of Hæmoglobin, to be taking Pil Blaud. under medical directions.

It is surprising to know the number of mild cases of Raynaud's disease, which are overlooked, the history of blanching fingers, which promptly improve with the exhibition of nitrites, being readily obtainable.

A type of case is every now and then noticed in which calcium salts are followed by successful results, and sometimes from these individuals we get a history of attacks of urticaria, whilst they may even show dermographism. Calcium chloride may be given in 15 gr. doses thrice daily. Cardiac tonics are often helpful, and a peculiarly happy combination, especially for old people, is that of Tincture of Strophanthus with Liquor Trinitrini.

It is desirable that the sufferer should be instructed to avoid chills, if possible, advised to wash in tepid water, and warned against warming his or her extremities at a fire, or making a rule of sitting near it. Children especially will be found to be guilty of romping from a warm fireside to a chilly outside atmosphere.

Local Measures.—Foot and hand wear must be carefully chosen ; warm it must be, tight it must not be, and it should not be rough and irritating.

Massage is very helpful, but especially so as a prophylactic. In the erythematous stage it may be too painful to be borne ; again, here careful directions as to method must be given.

Two drugs stand out pre-eminently as of value in the early stages, viz., Ichthyol and Formalin.

Ichthyol is well known to have a special effect in reducing congestion. Any strength may be used, but 10 to 20 per cent. in Lanolin serves most purposes. (I have used it in full strength painted on.)

This ointment, spread thickly on linen, and worn at nights on the affected parts, often dispels a commencing attack after a few applications. To get over the odorous character, sometimes objected to, its ally, Thigenol, may be used in its stead. During the day it may be used in the form of plasters, if convenient.

With the same end in view, I have tried Adrenalin and Adrenalin and Chloretone ointments, in a like manner, but, although praiseworthy and more suited to æsthetic minds, I do not find them so useful as Ichthyol.

Formalin, an equally powerful drug, is one requiring much more care to employ it satisfactorily. The odour is pungent, but, if there is the slightest abrasion of the skin, smarting effects are still more disagreeably evident. In ointment form, it may be used in 10 to 50 per cent. strengths; this method answers best when the patient has a sensitive skin, when, however, we have to deal with coarser skins, the remedy may be used pure.

The astringent action of the drug may go too far, and then the horny layer of the skin becomes hard and cracks. Consequently, after a few days, it is advisable to stop using it, and apply Lanolin or Vaseline. It can be subsequently resumed if necessary. As an antiseptic, it also prevents the complication of subsequent infection of the parts—there being many cases in which recovery is prolonged by the intrusion of surface organisms. If a distinction is to be drawn between these two agents, Formalin might be classed as more effective, more lasting in its results, but much harsher in its action, therefore more suited for the male sex, whilst Ichthyol might be described as more soothing, more simple in its method of application, and undoubtedly better suited for delicate skins. Treatment may accordingly, in some cases where there are cracks, be started with Ichthyol, and finished with Formalin.

Various other applications are also commonly applied at this stage. Of these, Iodine, either as tincture, or painted on

in Collodion (2 per cent. Iodine), Silver Nitrate in solution, and Camphorated Spirit, are best known.

Electrical methods have long been recommended, generally galvanism, but as this necessitates, in its simplest form, a considerable number of batteries, it is not universally handy. The Faradic current is easily used, requiring only a small coil with a bichromate cell, two small earthenware basins, such as are used in cooking, two small copper plates, and connecting wires. Warm water with a teaspoonful of salt is put in each basin along with a copper plate electrode, which is connected with a terminal of the secondary coil. The current may be varied by raising or lowering the zinc in the bichromate cell, by the draw-tube of the coil, or by altering the depth or position of the copper electrodes in the basin. When the hands or feet are involved, the secondary circuit is completed by the patient placing an affected member in each basin. When other parts, such as the nose or ears, are involved, then one copper electrode is covered with gauze, soaked in salt water, and applied to the affected spot; the circuit being again completed by placing a hand in the other basin, which contains the remaining electrode. Ten minutes of this treatment every night will act promptly in many cases. Recently, a patient had a severe attack on the left little finger and ulnar aspect of the palm. There were two large chilblains, and he could not bend the finger, he applied this method, and, next day, the pain was away, and only slight erythema left. Two sisters, both affected regularly every winter, came under observation, the one, more delicate and suffering from mitral stenosis, used the above means, and no chilblains appeared, the other did not and suffered. The plan suggested above is not new, but is apt to be overlooked in the rush after still more modern ideas. It may be said that the writer has found it very satisfactory chiefly in the early stages, and, while not interfering with the action of other remedies, produces more prolonged results.

An X-ray and high frequency outfit is not always present, but, if available, is more powerful than the Faradic current, can be used in all stages, and is possibly more lasting in its effects.

The treatment is much more expensive, but, in severely

recurring cases, should be tried. So far, with my limited experience, it is not possible to say which is better. Three cases have been tried with X-rays and three with high frequency, and although the action of each is different, both were successful.

X-rays have an atrophic effect, this being more pronounced on unhealthy tissue, hence they reduce inflammation and remove pain. Applied, as they have been by me, in doses of 10 minutes' duration, with a hard tube with · 5 milliampères in the secondary circuit, one or two applications have been followed by benefit, when continued thrice weekly, stopping short of reaction, the chilblains eventually disappear.

High frequency currents can be applied by the effleuve, or by the vacuum electrode. In all cases, it is wise also to improve the general tone by giving, at the same time, some 10 minutes of auto-condensation on the couch.

Theoretically, one might advise the use of X-rays, in cases consequent on passive congestion, while high frequency currents might be recommended where there was vaso-motor nerve spasm.

In the ulcerating stage, the most convenient application, apart from these electrical methods, is the following paste :—

℞	Hydrarg. ammoniati - - -	gr. v.
	Ichthyolici - - - -	min. x.
	Pulveris amyli,	
	Pulveris zinci oxidi - - -	āāʒii.
	Vaselini - - - - -	℥ss.

This spread unsparingly on linen, and changed frequently, suits most cases. If the ulceration is not severe, or healing is advancing, the recovery may be completed by Beiersdorf's zinc-ichthyol salve muslin.

In conclusion, by the various local means mentioned, coupled with general treatment, all cases should yield, and, if failure occurs, suspect a wrong diagnosis, and that the right one may be Lupus erythematosus.

A STATISTICAL INQUIRY INTO THE CASES OF CANCER OCCURRING AT TWICKENHAM FOR TWENTY-ONE YEARS, FROM 1882 TO 1902, WITH OBSERVATIONS AND REMARKS.

By J. R. LEESON, M.D., F.L.S., F.G.S.,

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THE following work was undertaken for the purpose of determining whether or no there were any "Cancer Houses" in this locality.

Having lived and practised in the district since 1879, it occurred to me that local knowledge of the streets houses and localities might be of use in throwing some light upon the subject.

Mr. Marston Clark, the Medical Officer of Health, kindly supplied me with copies of the official death returns, from which the data have been compiled; these have been faithfully tabulated, and are here presented in graphic form.

For the last few years, the inquiry has been discontinued, the rapid increase of the number of houses and inhabitants in the district rendering the locality unsuitable for the purpose; but up to 1902, the last of the years taken, the conditions were fairly stable.

The results were a pleasant surprise. First, they demonstrated, without any question, that there are no such things as "Cancer Houses" in this district, that of the 248 cases of deaths from cancer, during this period, all but four occurred in different houses, and these four at long intervals, and in two dwellings far apart. There were, however, several "Apoplexy Houses," and, had I pursued the subject, I have little doubt that I could have found "Measles Houses," and "Liver Houses" in number. I am convinced that there is no evidence here of any localised factor in the disease.

TOTAL NUMBER OF DEATHS FROM CANCER, OCCURRING IN THE DISTRICT OF THE TWICKENHAM SANITARY AUTHORITY, IN THE YEARS 1882 TO 1902, INCLUSIVE, 248.

Number of deaths occurring in the same houses - - - - - - - - 4
Number of deaths occurring in different houses - - - - - 244

Secondly, I was surprised to find no increase in the cancer death-rate in the district. This is quite contrary to what I had expected from general impressions, and, when one considers how greatly diagnosis has improved during the period, and how often the surgeon has been able to inspect the diseased tissues at the time of operation, and so not infrequently decide doubtful cases, it is very striking.

I am well aware of the difficulty of drawing accurate conclusions from death certificates, and none but those who have worked at the subject know how difficult it is, how often the certificate is vague, and sometimes, one is forced to think, purposely misleading. There is evident unwillingness at times to specify "cancer" or "malignant disease," and this one finds applies to other diseases, and especially to "alcoholism," and there is also an almost complete absence of post-mortem examinations. Such factors, however, are fairly constant over the whole period, and tend rather to diminish than to increase, at least this was my impression in going through the certificates, and if this is so, cancer deaths would apparently become more numerous instead of tending slightly to decrease, as they happily have at least in this district.

TWICKENHAM SANITARY AUTHORITY.

TABULAR STATEMENT OF THE DEATHS FROM ALL CAUSES, AND FROM CANCER FOR THE LAST TWENTY-ONE YEARS.

Year.	Total Number of Deaths from all Causes.	Deaths from Cancer.	Males.	Females.	Rates of Deaths from Cancer.
1882 - -	197	4	1	3	1 in 49·2
1883 - -	214	8	3	5	1 in 26·6

Year.	Total Number of Deaths from all Causes.	Deaths from Cancer.	Males.	Females.	Rates of Deaths from Cancer.
1884 - -	188	9	4	5	1 in 20·8
1885 - -	211	11	5	6	1 in 19
1886 - -	198	10	4	6	1 in 19·8
1887 - -	229	6	3	3	1 in 38·1
1888 - -	197	16	4	12	1 in 12·3
1889 - -	212	12	4	8	1 in 17·6
1890 - -	224	7	2	5	1 in 32
1891 - -	249	16	4	12	1 in 15·5
1892 - -	250	20	7	13	1 in 12·5
1893 - -	230	12	6	6	1 in 19·1
1894 - -	208	12	7	5	1 in 17·3
1895 - -	236	14	3	11	1 in 16·8
1896 - -	204	12	3	9	1 in 17
1897 - -	255	17	5	12	1 in 15
1898 - -	264	14	4	10	1 in 18·8
1899 - -	275	12	3	9	1 in 22·9
1900 - -	294	14	5	9	1 in 21
1901 - -	254	10	6	4	1 in 25·4
1902 - -	264	12	2	10	1 in 22
Totals -	4,853	248	85	163	1 in 19·56

Grouping these deaths into periods of five years, the results are as under :—

1882 to 1886 -	1,008	42	17	25	1 in 24
1887 to 1891 -	1,111	57	17	40	1 in 19·4
1892 to 1896 -	1,128	70	26	44	1 in 16·1
1897 to 1901 -	1,342	67	23	44	1 in 20

or into periods of ten years :—

1882 to 1891 -	2,119	99	34	65	1 in 21·4
1892 to 1901 -	2,470	137	49	88	1 in 18·7

It will be seen, from this table, that there is no increase in the death rate from cancer in the district, a fact that is more plainly shown in grouping together the deaths into

periods of five and ten years. This is quite contrary to what I expected, and also to the general belief that cancer is becoming more prevalent than in former years, a statement which is particularly emphasised in the recent report of the Imperial Cancer Research Fund for the year 1906–1907, in which it states that, whereas in 1889 one man out of 21, and one woman out of 12, died from cancer, in the year 1905 the death rate had risen to one man in 12 and one woman in eight.

OCCUPATIONS AS STATED IN THE DEATH CERTIFICATES OF THOSE WHO DIED FROM CANCER IN THE TWENTY-ONE YEARS, 1882–1902, IN THE TWICKENHAM SANITARY AUTHORITY DISTRICT, ARRANGED IN THE ORDER OF THEIR FREQUENCY.

Married (used only of females)	83	Widows	50
Of independent means	18	Gentlemen	10
Servants	8	Gardeners	7
General labourers	6	Annuitants	4
Cooks	3	House painters	3
Confectioners	2	Lieut.-colonels	2
Police constables	2	Hospital nurses	2
Carpenters and joiners	2	Architects and surveyors	2
Unknown	2	Barrister	2
Solicitor	1	Auctioneer	1
Overseer G.P.O., retired	1	Author	1
Journalist	1	Shorthand-writer	1
Civil servant clerk, retired	1	Coal merchant manager	1
Ladies' companion	1	Singer	1
Builder, retired	1	Farmer, retired	1
Fishmonger	1	Ironmonger, retired	1
Linen draper, master	1	Linen agent	1
Licensed victualler	1	General merchant	1
Cigar merchant, retired	1	Florist	1
Loco. supert.	1	Clothes dealer	1
Dressmaker	1	Soldier	1
Naval pensioner	1	Army pensioner	1
Carriage builder, master	1	Coachman	1
General carrier	1	Printer's foreman	1
Coppersmith, journeyman	1	Viceman	1
Blacksmith's journeyman	1	Whitesmith, master	1
Sailmaker, master	1	Coach painter	1
Farm bailiff	1	Laundryman	1
Laundress	1	Coal merchant's clerk	1
Bank clerk	1		
			248

Only two facts can, I think, be gleaned from this table, one of which is well known, that women are much more liable to the disease than men; and the other, that amongst males to be what is styled "of independent means," or a "gentleman," seems to increase the risk of cancer death.

I was disappointed, I must confess, at the varied occupations of the sufferers, no clue to the mystery can be obtained from them, and, with the exceptions mentioned above, all sorts and conditions of men seem equally liable to the scourge, but the better classes are certainly in the ascendency.

CLASSIFICATION OF CANCEROUS DISEASES, ACCORDING TO THE ORGANS AFFECTED, ARRANGED IN ORDER OF FREQUENCY.

Malignant diseases of the liver	Digestive system	30	133
„ stomach		27	
„ intestines		17	
„ rectum		15	
„ tongue		12	
„ abdominal viscera		7	
„ œsophagus		6	
„ mouth		5	
„ colon		4	
„ pancreas		3	
„ abdominal tumour		2	
„ throat		1	
„ parotid gland		1	
„ tonsil		1	
„ pharynx		1	
„ omentum		1	
„ uterus	Female organs of reproduction	26	64
„ breast		33	
„ vulva		2	
„ vagina		1	
„ pelvic		2	
„ face	Head and neck	3	11
„ neck		2	
„ skull		1	
„ brain		1	
„ orbit		1	
„ upper jaw		1	
„ thyroid		1	
„ axillary glands		1	

*Malignant disease of the heart	Organs of respiration and circulation	3		
„ mediastinum		2		8
„ lungs		2		
„ larynx		1		
„ hip	Lower extremity	2		
„ leg		2		6
„ lumbar region		1		
„ ankle		1		
„ bladder	Various	3		
„ kidney		1		6
„ penis		2		
Multiple sarcoma				1
Deaths returned as "scirrhus" cancer and malignant disease without any localisation				19
				248

SUMMARY.

Digestive organs	133
Female organs of reproduction	64
Head and neck	11
Respiration and circulation	8
Lower extremity	6
Various	7
Unspecified	19
	248

This table enforces the fact that the digestive organs are pre-eminently affected, almost twice as frequently as even the female organs of reproduction. From the general idea one gets in practice, I had no idea the difference was so strongly marked. Practically these two groups of organs, when one eliminates the 19 cases in which no organ is specified, comprise the whole.

Can any hint or suggestion be gleaned from this? It seems to me to warrant the suggestion that decreasing cellular activity is here the factor, and that the cancerous condition pre-eminently affects declining organic vigour; the female

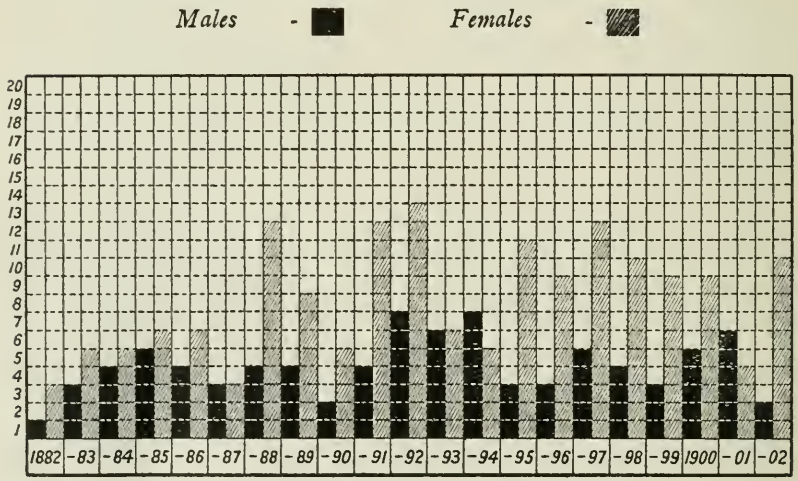
* This is remarkable; in the Registrar General's report, in the four years 1901 to 1904, out of a total of 114,130 deaths attributed to cancer in England and Wales, no death is referred to cancer of the heart; it should be noted however that all the cases occurred in the practice of the same individual, but how apart from post-mortem examination (of which there is no evidence on the certificate, and not much probability otherwise) the condition could have been diagnosed, I am at a loss to understand. I never heard of the complaint before I saw it here, and do not know that even now I feel very convinced about its existence.

organs of reproduction, soon after middle life, become old, decay, and are then relatively much older than the rest of the body cells, are decaying, in fact, when the rest of the body is still active.

The digestive organs would seem to tell the same tale; when one thinks of their enormous activities, and of the perpetual cellular repair which they have to undergo in order to carry on their work, a process that must lead to their ageing, and relative exhaustion in advance of the other body cells, whose perpetual renewal is not such a necessary condition of their activity.

We know that cancer is a disease of *advanced life*, and in these organs we have *relative senility*, and *relative advance*, and consequently a failure either to resist an invading organism if that is the cause of cancer, or a loss of power to control a local cellular anarchy, if that is the root of the trouble.

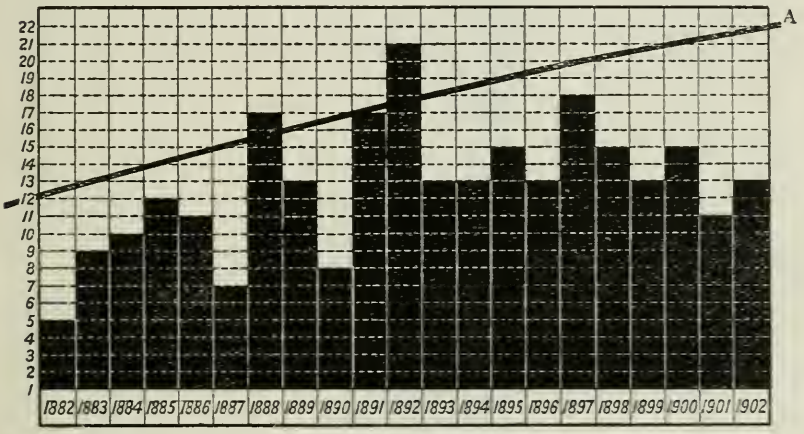
CHART OF THE DEATHS OF MALES AND FEMALES FROM CANCER IN THE TWICKENHAM SANITARY AUTHORITY DISTRICT FOR THE 21 YEARS, 1882 TO 1902. EACH SHADED SQUARE REPRESENTING ONE DEATH.



85 males and 163 females, or very nearly 1 male to 2 females over the whole period.

From the year 1888, the proportion of females to males is shown to be distinctly on the increase, in the year 1882 it was 3 to 1, whilst in the year 1902, it was 5 to 1, and this again is contrary to recently published statements that the mortality from cancer in the two sexes is approximating.

CHART OF NUMBER OF DEATHS FROM CANCER IN THE TWICKENHAM SANITARY AUTHORITY DISTRICT FOR THE YEARS 1882 TO 1902, COMPARED WITH THE INCREASE OF POPULATION DURING THAT PERIOD.



A.—*Line of population.*

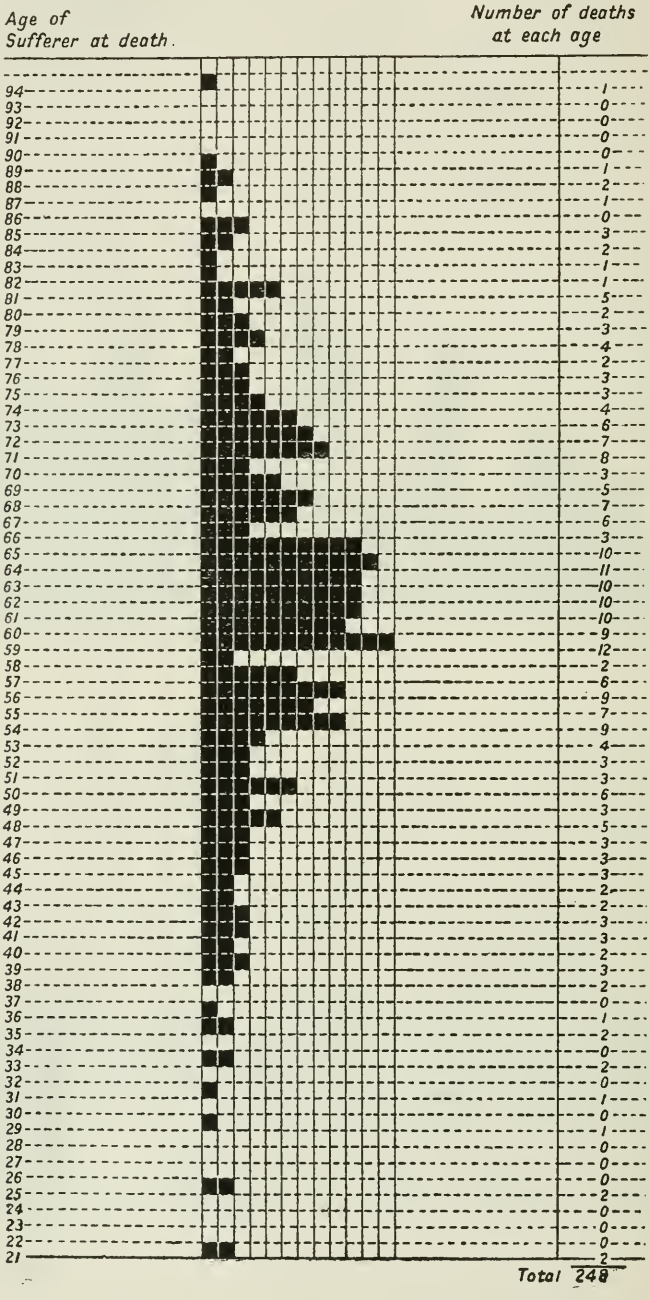
Population in year 1881 according to official census, 12,479; in 1891, 16,026; in 1901, 20,991. The statistics are not brought further than 1902, as since this date the increase of population has been very rapid, and no official census occurring since 1901, no reliable figures are available.

In the above chart, each vertical column represents one year, the date of the year being placed along the bottom row.

Each little oblong in each vertical column represents one death from cancer in the district in the year, and also one thousand persons living in the district according to the official census.

It will thus be seen that, during these 21 years, there is no rise in the cancer death rate in the district, which remains remarkably constant when the diagram is looked at as a whole.

CHART SHOWING THE DIFFERENT AGES AT WHICH PEOPLE HAVE DIED FROM CANCER IN THE TWICKENHAM SANITARY AUTHORITY DISTRICT FOR THE 21 YEARS, 1882 TO 1902. EACH SHADED SQUARE REPRESENTING ONE DEATH.



Cancer is here shown to be a rare disease in people below 40 years of age. From 39 to 52, the increase is marked, and remains fairly constant. From 54 to 73, it increases greatly, attaining its greatest frequency between 59 and 65. From 67 to 73, it is still very large, after which it appears to decline, though from the smaller number of people living at that age, it must relatively be much greater.

AVERAGE AGE OF PEOPLE DYING FROM CANCER IN THE TWICKENHAM SANITARY AUTHORITY DISTRICT FOR THE 20 YEARS, FROM 1882 TO 1901, GROUPED IN PERIODS OF FIVE YEARS.

Year.	Number of Deaths from Cancer.	Combined Ages of the People thus Dying.	Giving an Average Age of each Person Dying from Cancer in this District, during these years, of—
1882	42	2,655	63·21 years.
1883			
1884			
1885			
1886			
1887	57	3,192	56 ,,
1888			
1889			
1890			
1891			
1892	70	4,377	62·52 ,,
1893			
1894			
1895			
1896			
1897	67	4,137	61·74 ,,
1898			
1899			
1900			
1901			

The average age of all persons dying from cancer within these 20 years was 60·86 years.

It will thus be seen that the age of people dying from cancer has remained very constant, and that there is no tendency for cancer to attack people at an increasingly earlier age, as has been alleged.

SUMMARY AND CONCLUSIONS.

There are no cancer houses in this district.

There is no increase in the cancer death-rate.

Occupation gives no clue to the mystery, except that affluence seems to be a contributing cause.

Practically the disease is confined to the digestive organs and the female organs of reproduction, and in the proportion of two of the former to one of the latter.

Females are twice as liable to the disease as males, and even this ratio is rapidly increasing to their disadvantage.

The older the individual the more liable to cancer.

The age of the victims remains very constant, and there is no tendency for cancer to attack people at an earlier age.

CHOREA, AND A CONVENIENT AND TRUSTWORTHY METHOD OF EXHIBITING ARSENIC THEREIN.

By J. GORDON SHARP, M.D. Edin.,
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Speaking generally, arsenic, in the form of arsenious acid, stops the movements of chorea, but it does so only when administered in doses considerably above the average. Small or average doses, although continued over a long period, fail to stop the movements, or, to put it in another way, slow saturation of the tissues does not "cure" the chorea. For the remedy to be effective, the tissues must be rapidly saturated with it. In proof of this assertion, I cite the following examples:—A child, of 12, took 900 minims of arsenical solution (about 9 grains or 0·583 gramme of arsenious acid) in two calendar months, or at the rate of 5 minims three times a day, without benefit (*see* Case 1), while another child, of the same age, was "cured" when she had taken 600 minims (about 6 grains or 0·389 gramme of the acid) within a period of 16 days, or at the rate of $12\frac{1}{2}$ minims three times a day (*see* Case 2).

My object, in the present article, is twofold:—(1) To show that the method, usually employed to saturate the tissues, is unsatisfactory and uncertain; and (2) that the dosage of 35, 30, 25, 20, or even 15 minims given to effect this saturation, is unnecessarily large.

In illustration of these points:—A patient is prescribed an arsenical mixture, and told to take one-teaspoonful doses the first day, and to increase this by a half, or a whole, teaspoonful every day, till four or five teaspoonful doses have been reached. The arrangement gives rise to considerable confusion in the mind of the educated individual, but what must it produce in the mind of the average person, not to mention the hospital out-patient? After the second day, the poor patient has only a hazy notion as to whether it is the "two-spoonful" or the "three-spoonful" day; and the physician has only a vague

idea of the amount of arsenic that is being taken, or has been taken. A second, and more serious, disadvantage is that by the time a dose of 15 minims is arrived at, the patient may repeatedly vomit both food and medicine, no matter how gradually the arsenic may have been increased. The result of all this is that the remedy is stopped, and confidence is lost. I have found, by experience, that, as soon as the dose is increased beyond 12½ minims, there is danger of the arsenic being rejected (*see* Case 6). My contention is, then, that it is possible to rapidly saturate the tissues, and so stop the choreic movements, without producing the symptoms of acute poisoning, and by doses very much smaller than those usually prescribed, and considered necessary to relieve the chorea.

Method of Application.—Whenever I have under my care a case of chorea of from 8 to 15 years of age, and between these ages one oftenest meets with the affection, I prescribe the following :—

Take of Arsenical Solution (Fowler's)	240 (or sometimes 300) minims.
Tincture of Capsicum - -	25 minims.
Liquid Extract of Liquorice -	240 minims.
Chloroform Water - -	6 fl. oz.
Water to - - -	12 fl. oz. Mix.

Take one tablespoonful three times a day immediately after meals.

As will be observed, 240 minims represent a dose of 10, and 300 minims a dose of 12½ minims. Since arsenical solution is of the strength of 1 per cent., each dose of 10 or 12½ minims will represent respectively about $\frac{1}{10}$th grain (0·0065 gramme), and $\frac{1}{8}$th grain (0·0081 gramme) of arsenious acid, and, practically speaking, in a week the patient takes 2·40 or 3 grains (0·156 or 0·194 gramme), according as the prescription has contained 240 or 300 minims.

The quantity in the foregoing prescription is for eight days, or, roughly, a week, and this is useful in out-patient practice, for no case of chorea should be left unseen for a longer period than one week. In private practice, it is better, perhaps, to prescribe only half the quantity, namely, 6 oz. There is a reason for all the adjuncts of the prescription. (1) All vege-

table extracts are good vehicles of arsenic. Gentian, calumba, and especially cascara for adults, but, for children, liquorice is the best because it is pleasant. Chloroform and capsicum are anæsthetic to the mucous membrane of the stomach, and, in addition, the chloroform helps to preserve the mixture in warm weather.

When I see a patient for the first time, as a rule, I prescribe 10-minim doses, but, if at the end of a week I see no signs of improvement, I increase the dose to 12½ minims. The latter procedure is not often necessary, for distinct improvement is more often than not observed at the end of the first week on a 10-minim dose. It may be laid down, as a good working rule to follow, that, if arsenic is going to do good in chorea, it will show its beneficial action within the first fortnight. When the remedy is doing good, I continue it till the patient can walk along a straight line, and stand on the leg of the affected side with steadiness. This usually represents a period of three or four weeks, or, at the outside, six weeks.

After Treatment.—After all movement has ceased, I like to keep the patients under observation for three or four weeks, if I can, and meanwhile they take the following :—

Take of Sodium Bicarbonate - -	120 grains.
Tincture of Capsicum - -	25 minims.
Liquid Extract of Liquorice -	240 minims.
Chloroform Water - -	6 fl. oz.
Water to - - -	12 fl. oz.

Mix and dissolve.

Take one tablespoonful three times a day immediately after meals.

When I am asked why I prescribe this mixture, I reply that the bicarbonate washes the arsenic out of the tissues. The statement may not be scientific, but I know the medicine does good, and that is the chief thing.

Quantity of Arsenic taken.—The last six cases, I have had under my care, have taken respectively 480, 600, 720, 840, 1,440, and 1,520 minims of arsenical solution, representing in grains of arsenious acid about 4·80 (0·311 gramme), 6 (0·389 gramme), 7·20 (0·465 gramme), 8·40 (0·541 gramme), 14·40 (0·933 gramme), 15·20 (0·987 gramme).

I am not going to discuss the question as to how the arsenic acts in chorea, but this I do assert, that the remedy may stop all twitchings or, in popular language, cure the affection, and yet leave all the deep reflexes untouched, as exemplified in the case of a patient, who took 15·20 grains of arsenious acid, got well, and the knee-jerks were as active at the end of this time as they were before any of the remedy had been taken (Case 6).

Varying State of the Deep Reflexes in Chorea.—Chorea is a complex combination of pathological conditions:—(1) The whole motor tract, from the cortex above down to the motor nerve-endings in the muscles may suffer. (2) All the various portions of the tract may not suffer in an equal degree. Thus the condition of the reflexes will depend on the extent of the tract affected, as well as on the severity, with which the various portions are attacked. One portion may be stimulated, while another portion may be depressed, or inhibited, while yet, in another instance, the whole tract may suffer inhibition, and so, in this way, one may account for the cases of paralytic chorea. If the upper motor neuron is severely affected, its restraining influence on the lower neuron is removed, and hence the reflexes are excited. Experience testifies to the correctness of this assertion, for in those patients, in whom speech is affected (hence attack of the upper neuron), the knee-jerks are generally exaggerated. On the other hand, if the lower neuron is specially marked out for attack, the knee-jerks may be depressed or be even in abeyance.

The Psychical Element in Chorea.—The fact of the presence of a psychical element in chorea offers an obstacle to the acceptance of either the embolic, or the microbic, theory of the malady, but the line of argument, which I have hitherto followed, is in complete agreement with the acceptance of fright or other "shock" to the nervous system, as a cause of chorea. Shock disturbs the equilibrium of the nerve cells, and there is no reason why a specially selected portion of the nerve tissues should not be marked out for attack. We do know that every poison has its own particular selective area, without any clear reason why it should, for a poison has free play of the whole of the nervous tissue of the body. Further, and to conclude, fright or other "shock" may

produce the same kind of damage to nerve tissue as poisons or embolism.

Thus, while there is one primary causal agent in chorea, the immediate causes are many, and hence the "cures" are many. In one patient, discipline alone may stop the movements; in another, rest in bed is all that is needed; while, in another, curare acts beneficially by depressing the motor nerve-endings, and so freeing them from impressions from the periphery. In yet other patients, bromide of potassium stops the movements by depressing the reflex centres in the chord, and thus indirectly giving rest to the jaded muscles. Occasionally, salicylate of sodium does good where there is an immediate connection with a rheumatic arthritis. Here, again, the benefit is brought about indirectly by the salicylate acting as an analgesic to the tender joints. Strychnine is useful, in some cases, by acting on the motor cells of the anterior horns, and through them on the muscles, and through the muscles on the circulatory system by improving its tone. But *the* remedy, which acts in the great majority of cases, whatever may be the immediate cause of the chorea, rheumatism, scarlet fever, fright, or other ailment, is arsenious acid in moderately large doses.

The following notes of six cases will help to make clearer the points raised in the foregoing remarks; and, as will be observed, the time during which the patients were under treatment, was quite as short as it would have been had heroic doses of arsenic been given.

Case 1.—A boy of 12, who had taken 5 minims of arsenical solution three times a day for two calendar months without effect on the twitchings, had scarlet fever when five, but no rheumatism, although an elder brother suffered from it. There was no heart affection. Movements in right arm, leg, and right side of face. Knee-jerks absent, but, as stated above, he had, previous to my seeing him, taken 900 minims of arsenical solution. He was now put on 10 minims three times a day, and a week after hardly any twitching could be detected. In 16 days, after first beginning the 10-minim doses, he was quite well. He had taken 480 within this period. I have not included the 900 minims, spread over the two months, because they appeared to have no effect on the course of the disease. After all movements had ceased, the boy was kept under observation for a month, while taking the bicarbonate of sodium mixture.

Case 2.—Girl, aged 12. No scarlet fever, and none of the family had rheumatism; child herself no definite history of rheumatism, except that,

five weeks before coming to the out-patient room, she had been laid up for nine or ten days with "rheumatism," so called. The twitchings extended to both sides, including the face, the left side suffering the most. There was lateral nystagmus. The apex beat was diffused, and a thrill was felt over the heart area, but no definite heart murmurs could be detected. The knee-jerks were excited. Twelve and a half minims were prescribed three times a day, and, in a week, hardly any movement was seen, and a week later, and after she had taken in all 600 minims, the child was apparently well.

Case 3.—Girl of 11. Mother of child had had rheumatism, but the girl had neither had rheumatism nor scarlet fever, although she is said to have had an attack of chorea two years previously, but no particulars of it could be obtained. The movements were restricted to the right arm and leg. A thrill was felt, and a presystolic murmur heard in the mitral area. Ten minims of arsenical solution were prescribed in the usual way three times a day. Improvement followed at the end of the first week, and, in four weeks, the child was well, all twitchings having disappeared for 10 days before the medicine was stopped. She took 720 minims in all.

In the case of this child, I was able to show, a circumstance not generally appreciated in connection with mitral murmurs in children, and especially in connection with presystolic murmurs, namely, that the murmur is often most distinctly heard in the lying posture. It is demonstrated as follows:—The child is first auscultated in the upright position, and then allowed to lie down till all disturbance, due to the movement, has passed away, when it will be found that a murmur, which was barely audible in the standing or sitting position, is now clearly heard. The murmurs appear to be nearer the surface in the lying posture. The difference may perhaps be accounted for by the more compact shape which the heart muscle assumes in the lying position. I always employ the single wooden stethoscope in listening to doubtful murmurs, for it seems to convey sound more sharply than the binaural instrument.

Case 4.—Girl of 13. Said to have been in bed for one week, owing to an indefinite illness, which the mother called rheumatism. No other member of the family had rheumatism. At four, the child had scarlet fever, and she had two previous attacks of chorea, when she was 10 and 11 years old; a diffused thrill was felt over the heart area, but no murmur was heard. The twitchings were restricted to the right arm and leg.

Before I saw the child, she had been prescribed 3 minims of arsenical solution three times a day for one week, and thereafter 4 minims three times a day for two weeks, without any effect on the movements. I at once increased the dose to 10 minims three times a day in the usual way. In a week, great improvement was seen, but I further increased the dose to 12½ minims three times a day, and this was continued for 16 days when she was quite well. She took 840 minims, not including the 160 or so minims taken during the first three weeks.

Case 5.—Girl aged 15. No history of rheumatism, either in the child, or in her family. She had not had scarlet fever, but four years ago she had chorea, and was ill for three months. When she first came to the out-patient room, she had to be helped by two women, the movements being so universal, violent and continuous. Owing to the intense twitching and

to the rapid action of the heart, it was not possible to auscultate the heart satisfactorily. The usual mixture was prescribed in 10-minim doses, three times a day, and, at the end of a week, and when she had taken 240 minims of arsenical solution, she was able to walk into the consulting room without assistance. Five weeks later—that is, six weeks after having been first seen—she was able to go through all the tests without a hitch, all twitchings having ceased for nearly three weeks. Altogether she had taken 1,440 minims.

Case 6.—Girl of 15. No history of rheumatism in patient or family. No scarlet fever, and no previous attacks of chorea. The mother attributes the chorea to the fright which the child received at the onset of menstruation. There was no heart affection. Movements were confined to the right arm, leg, and right side of face, and there was slurring of speech. The knee-jerks were excited, more especially so on the right side. For the first 10 days, she was given 12½ minims three times a day, and with great benefit when the dose was reduced to 10 minims three times a day. At the end of 10 days, she was apparently well, all twitchings having ceased for some days. She had taken 720 minims.

The bicarbonate of sodium mixture was now prescribed, but, in a fortnight, the choreic movements returned in a mild form. The arsenical solution was again given in 12½-minim doses three times a day, and continued at this rate till 800 minims had been taken, although all the movements had ceased, and the girl was able to stand on the leg of the affected side, and to walk along a straight line, 10 days before the arsenic had been stopped. She had taken, from first to last, 1,520 minims. After the arsenic was stopped, she was kept under observation for over a fortnight, still taking the bicarbonate mixture. The knee-jerks were as active, when she had finished taking the arsenic, as they were when she began.

Vomiting always followed when the patient took a large dose, that is when she slightly exceeded the 12½-minim dose.

LEADERS IN MODERN MEDICINE.

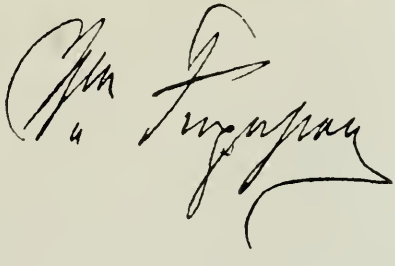
IV.

SIR WILLIAM FERGUSSON.

[With Plate III.]

THE truth of the aphorism *poeta nascitur non fit* is universally admitted, but there is no doubt that it applies equally well to all great surgeons, and to none does it apply with greater fitness than to Sir William Fergusson. It often happens that a lad commences a career for which he is not specially adapted, only to find that there are qualities in him which, if cultivated and developed, combine to make him famous, and enable him to render distinguished service to society in a sphere of labour altogether different. Clive, the distinguished Indian General, and Morley Punshon, the celebrated Methodist orator, commenced their business life as clerks. Lord Beaconsfield was articled to a solicitor, and Sir William Gull began life as an usher in a private school. It appears that, by his own desire, Fergusson was placed in a lawyer's office, soon, however, to find that the work was uncongenial, and that his ideas were mechanical rather than argumentative. So, after two years' experience of desk drudgery and legal lore, in accordance with his father's original wishes, he exchanged the law for medicine. Thus was commenced a career in which Fergusson became foremost in the surgical world, and a leading representative in anatomical and surgical science, a career in which all his energies were devoted to the furtherance of professional interests, and for which time and toil were ungrudgingly sacrificed.

William Fergusson was born at Prestonpans on the 20th of March 1808, and was educated at Lochmaben, and subsequently at the High School and the University of Edinburgh. His education was completed under the guidance of his uncle, Colonel, who afterwards became General, Fergusson. As already indicated, he ultimately determined on entering the medical profession, and at once became an enthusiastic student of anatomy. His skill in dissections and his mechanical



genius soon attracted the special attention of his tutor, Dr. Robert Knox, who appointed him, at the age of twenty, as demonstrator of anatomy to his class of 400 students. So zealous was he in the prosecution of his anatomical studies and dissections, that he would often spend from 12 to 16 hours a day in the dissecting room. Two specimens of his elaborate dissections are preserved in the museum of the College of Surgeons, Edinburgh, one of them, that of the nerves of the face, being upon a stand of his own cabinet work. Fergusson became a licentiate of the College of Surgeons, Edinburgh, in 1828, and a Fellow in 1829. In 1831, he was elected Surgeon to the Edinburgh Royal Dispensary, and subsequently to the Royal Infirmary, and, during the first year of the tenure of his office, he successfully performed the operation of ligature of the sub-clavian artery, an operation which had only been done twice before in Scotland. In this he gave evidence of a coolness, power, and capacity which placed him on a level with Syme, then the recognised head of the surgical profession in Edinburgh. His marriage, in 1833, with Miss Helen Hamilton Ranken, daughter and heiress of William Ranken, of Spittlehaugh, Peeblesshire, placed him in easy circumstances, so that, favoured by fortune, fame, and family, he soon occupied a leading position in Edinburgh.

At the age of 32, he decided on leaving Edinburgh for London, when he received many public marks of affection and esteem. In presenting him with a silver salver, Professor Lizars said that his removal would deprive them of an esteemed and valued friend, and a surgeon distinguished in the profession, and invaluable to the work, in Edinburgh. The occasion of his removal to the South was his election to the Chair of Surgery in the Medical Faculty of King's College, and Surgeon to the newly established Hospital. He came as a stranger to London to compete with men who were well known and well established, and, by the vote of the Professors at King's, was placed in a position which made him at once the rival of Liston, who was then the greatest operator in London. The other leading men at King's were Watson, Green, Robert Ferguson, Todd, Budd, and Partridge, and, when the old workhouse of St. Clement Danes was turned into a Hospital, and William

Fergusson joined the staff, its success was assured. Liston was then at the tip-top of his reputation at the North London Hospital, but, by his own splendid abilities, his amiability, sincerity, and simplicity of character, Fergusson soon attracted attention, and made many friends. He became Member, in 1840, and Fellow, in 1844, of the Royal College of Surgeons, England, and his practice as a Surgeon rapidly developed, while the fame of his operative ability attracted many students and visitors to King's College Hospital.

Fergusson's chief competitors in London were Liston and Aston Key, both highly distinguished for their skill as operating surgeons, but Liston was at times rash, while Fergusson was always particularly cautious, and capable of complete self-command, and the death of Aston Key paved the way to his greater success. The rivalry of Syme was short-lived, for he soon returned to Edinburgh.

Honours soon fell thick upon him. In 1885, he succeeded Key as Surgeon Extraordinary to the Queen, having previously been appointed Surgeon-in-Ordinary to the Prince Consort, and, in 1867, he succeeded Sir William Lawrence as Sergeant-Surgeon to the Queen. In 1866, he was created a Baronet, a distinction announced to him in an exceedingly complimentary letter from Lord John Russell. This led to a presentation to him, at the annual dinner of old King's men, of a silver dessert service, of the value of £400, from three hundred of his old pupils. He was elected into the Council of the College of Surgeons in 1861, made Examiner in 1867, and chosen President in 1870. In 1864 and 1865, as Professor of Human Anatomy and Surgery, he delivered two courses of lectures, which were afterwards published, before the College of Surgeons, in which he could point to three hundred successful operations for hare-lip, a circumstance which showed a revival of the operation which had been considered valueless. He was President of the Pathological Society, in 1859–60, and of the British Medical Association in 1873. In 1875, he received the degree of LL.D., *honoris causâ*, from the University of Edinburgh, and he also became a Fellow of the Royal Society. His papers, in the *Medico-Chirurgical Transactions*, which described the surgical relations of the levator muscles of the palate, and their action in preventing union of cleft palate, laid the basis of his brilliant

success, which was considerably enhanced by the publication of his *System of Practical Surgery*,

Fergusson's reputation rests not merely on the fact that he was a brilliant operator, but also on the fact that his system of operative surgery was eminently "conservative," and by this is meant that he applied and extended the principle of preserving those parts of the body which would, under more drastic treatment, have been otherwise sacrificed. He considered no portion of the body too small for preservation, if it was possible to save it.

His operation for cleft palate, which consisted in the free division of the levator palati muscles before bringing together the edges of the soft cleft, produced admirable results, and was followed by as great a success as previous failure. This alone would have secured him a great name. At first, he succeeded in only closing the soft palate, but, later, he devised a method, by means of which he split the bony palate on each side of the cleft, and brought the edges together by means of sutures through holes in the edge of the cleft.

Other operations, with which his name will be identified both at home and abroad, are those on the jaws, the excision of joints, especially the elbow, hip and knee, lithotomy, lithotrity, and amputations of limbs. His manipulative and mechanical skill was manifested both in his mode of operating, and in the instruments which he designed. These latter are a monument to his genius, while in the former he displayed rapidity, coolness, and a certainty and delicacy of manipulation difficult to equal, and perhaps impossible to surpass. Everything, to the minutest detail, was carefully planned beforehand, and carried out with precision. He never lost patience or grudged time, and always enjoined perfect silence during an operation.

Out of the operating theatre, Fergusson did not shine as a lecturer. This was largely due to his reticence, and imperfect command of abstract subjects, and his views on pathology were somewhat archaic. His self-command and temper, never disturbed by unforeseen circumstances, were very striking. It is recorded of him that, on one occasion when a student, perhaps better versed in book-knowledge than in ward-work, told him that the views on caries and necrosis, which he had

been expounding, did not agree with those of Niemeyer, he drew himself up and said : "Sir, Nehemiah was a gentleman, who wrote one of the books in the Old Testament, but I have yet to learn that he had views on caries and necrosis." His address at the British Medical Association was not a success ; it lacked cogency, and showed an imperfect grasp of large subjects.

In some expressions of opinion, he was not well advised, especially in matters relating to hygiene and physiology, in which his knowledge was somewhat imperfect. He gave evidence before the Royal Commission on vivisection, which showed a want of accurate physiological knowledge, and assumed certain relations, at one time, with homœopathists, which he was led to subsequently abandon. His errors were largely due to his amiability and kindliness of disposition, and whatever faults he had were the outcome of a deeply sympathetic nature.

As already indicated, Fergusson was an excellent mechanic, in this respect outrivalling many a skilled artisan. He was a good violinist, and a devoted disciple of Isaak Walton. Tall, dignified, and of good presence, he was a genial companion and an excellent host, and, although his exterior gave the impression of reserve and impassibility, there was beneath a warm and unselfish disposition, ever considerate of others, and ready to display a liberal charity.

In 1870, Sir William Fergusson retired from the chair of Surgery at King's College, but retained that of Clinical Surgery, and the position of Senior Surgeon until his death. He used to spend his holidays in Spittlehaugh, and, while there in 1875, complained, for almost the first time in his life, of not feeling well. In the following winter, bronchial irritation with mischief about the chest and heart appeared, and his colleague and friend, Dr. George Johnson, at once detected renal disease. Though he rallied for a while, the end came in February 1877. He was buried at West Linton, Peeblesshire, where his wife had been buried 17 years before. His portrait by Lehmann was presented to the Royal College of Surgeons in 1874, and a replica is in the College of Surgeons, Edinburgh.

NOTES FROM FOREIGN JOURNALS.

TREATMENT OF DUPUYTREN'S CONTRACTION BY THIOSINAMINE.

Langemak has sought to hasten the treatment, which, under ordinary conditions, tends to be long and painful. If there is much pain, he advises that the injection should be given while the patient is under an anæsthetic, and, at the same time, the cicatricial bands may be forcibly stretched. He begins with 1 c.c. of a 10 per cent. solution in water, and gradually increased the strength up to, but not beyond, 20 per cent. In this way may be avoided the after effects on the system which have been noticed occasionally—pyrexia, loss of appetite, fatigue, and general malaise. The injection must always be made well under the skin; if too close, it may give rise to sloughing. The urine should always be examined for sugar before treatment. When the nodes are thick, and if there are adherences to the skin, a bistoury may be necessary. The patient must keep up the result, once secured, by means of bathing the hand in hot soapy water, and forced extension of the fingers.—(*Münch med. Woch.*)

COMBINATION OF THIOSINAMINE AND ANTIPYRINE.

Michel, of Paris, has reported that, when these two bodies are mixed together, a liquid is formed, syrupy in consistence, more soluble in water than fibrolysin, odourless, colourless, and causing no pain.

In their treatment of deafness, due to adhesions in the ear, Lermoyez and Mahn make use of the following:—

℞. Thiosinamini - - - - ʒiv.
Phenazoni - - - - - ʒij.
Aq. destill. - - - - ℥iiiss.
Misce. Ft. lotio.

An ear-bath (hot) of this solution is given every evening, and the membrana is massaged twice a week.—(*Revue de Thérapeutique.*)

TREATMENT OF ABNORMAL DIGESTIVE FERMENTATIONS.

Formerly these were treated by antiseptics, such as benzo-naphthol, salol, etc., but Bardet has demonstrated the uselessness of these, and has returned to the use of special antiferments to inhibit lactic or butyric fermentation.

For lactic acid fermentation, he gives fluoride of ammonia, a substance, currently employed as an antiferment in breweries and distilleries.

℞. Ammonii Fluoridi - - - - gr. iij–viiss.
Aq. destill. - - - - ℥x.
Misce. Fiat mistura. Cap. ℥ss post cibum.

For butyric fermentation, is used erythrol, a red powder insoluble in water, which is a double iodide of bismuth and cinchonidine.

℞. Bismuthi et Cinchonidinae Iodidi - - gr. ¼–iss.
Calcii Fluoridi - - - - - gr. ¼–iss.
Cretæ Præparatæ - - - - gr. iss.
Misce. Fiat pulv. In cachet sumend. post cibum.

Iodide of sulphur, taken at meals in a dose of gr. iss. in a cachet, is an

effectual remedy for the fermentations which accompany true flatulence, the eructation at intervals of gas produced in the stomach; as distinguished from that due to air-swallowing which is almost continuous, and for which the remedy is of no avail. Precipitated sulphur checks lactic fermentation, and stimulates intestinal contractions. It should be given in a dose of gr. xv. mixed with an equal amount of calcined magnesia in a cachet at each meal.

Feculents and sugar must be limited in the diet. Uncooked fruit should only be eaten at the beginning of the morning meal.—(*Bulletin gén. de thérapeutique.*)

DOES OPIUM PRODUCE METEORISM?

Drenkharn, in the *Therap. Monatshefte*, answers this question in the negative, basing it upon observations on a case of opium poisoning, unaccompanied by meteorism, and on other analogous cases. He considers that the fear of this complication is unfounded, and that, in the numerous cases recorded as occurring after giving opium, the meteorism was either already present, or would have developed in any case. It is difficult to admit that a drug, which quiets irritability of the peritoneum, sets up the same sort of action as the irritability itself. There is therefore no reason for withholding opium in cases of appendicitis, but rather the contrary.

Prof. Pel, of Amsterdam, also deals with a similar question in the *Berlin. klin. Wochenschrift*, pointing out that the condemnation of opium has come from the surgical side. He himself does not abstain from its use in perityphlitis, because it facilitates rest in bed, and promotes the localisation of the inflammation by suppressing the peristaltic movements, and thus protecting the adhesions. For successful use, laudanum should be given with a little alcohol or sherry, in order to prevent nausea. A medium dose would be 5 minims every two hours, taking into account the intensity of the pain. If speedy action is wanted, a beginning may be made with an injection of morphia. Pel states that he has never observed the paralysis of the bowels and absorption of toxines alleged against it, and that it does not produce chronic constipation, but, on the contrary, promotes evacuation when the crisis has passed. As to masking symptoms, meteorism can be avoided by the use of moderate doses, and, moreover, other clinical symptoms are present, which replace the information yielded by palpation. Operation, during the acute stage, is not possible in three-quarters of the cases, so that the best treatment is absolute rest in bed, strict diet, ice locally, and opium in suitable doses.

A NEW PREPARATION OF ALUMINA.

In the *Therapeutische Monatshefte*, Saalfeld describes a new powder for general use, the active principle of which is a solid form of acetate of alumina. The liquid form has long been used in Germany as a cheap and efficient antiseptic. Eston, as the new product is called, is a basic acetate of alumina, in which two out of the three valencies of aluminium hydrate are saturated with acetic acid. It is a fine white powder, indifferent to air and light, of neutral reaction, insoluble in water, and not staining. In the presence of alkaline organic fluids, like blood, pus, etc., it gradually decomposes, yielding the soluble acetate, a non-irritating astringent and antiseptic; the powder remaining undecomposed, being porous, acts as a drying agent. Pure eston is not suitable for use, and must

be combined with some indifferent powder or used in an ointment. The action being very gradual, it was found that combination with formic acid produced a more energetic substance. This has been called "Formeston," the acetic acid of one of the valencies of the alumina hydrate being replaced by formic acid. It must also be mixed, for use, with a powder or an ointment.

Both eston and formeston are used with 10, 20, or 50 per cent. of talc, or equal parts of talc and zinc oxide. A mixture of 50 per cent. powder with 10 per cent. balsam of Peru is quite dry. Saalfeld found the following ointment effectual :—

℞. Formeston,
Ol. Olivæ - - - - - - āā part. j.
Aq. destill.,
Adipis Lanæ - - - - - - āā part. ij.
Misce. Ft. ungt.

These combinations, powder and ointment, exert a marked drying effect upon moist skin affections, and allay irritation. Among the affections mentioned by Saalfeld, which have responded quickly and satisfactorily to the use of one or other of the combinations, are eczema, erythema multiforme, ulcer of the leg, balanitis, impetigo, and intertrigo.

A NEW TREATMENT FOR TUBERCULOSIS.

Lemoine and Gérard, of Lille, read a paper at the *Académie de Médecine* upon a treatment of tuberculosis, based upon the antitoxic action of the liver. They point out that bile and the biliary acids are known to have a true chemical neutralising effect upon the venom of the biles, and that cholesterine, in particular, behaves as an antitoxic substance. They made a series of experiments to determine whether cholesterine and bile extracts possess any immunising properties against the poison of tubercle. Bacilli were injected into the peritoneum of guinea-pigs, to which were, later, given hypodermic injections of cholesterine and of biliary extracts, obtained from the bile by petroleum ether. The injections produced no unfavourable reaction, and a greater resistance to tubercle was noted in the animals experimented upon. There was no development of tubercle. In the wards, Lemoine used the same products for injection, and found in the patients, submitted to the treatment, improved general condition, lessening of the night sweats, of the fever, and of the frequency of the pulse, increased arterial tension, return of appetite and increase in weight. The results obtained in over 250 patients, treated during the last three years, have been that in tuberculosis of the first and second degree, the improvement has been complete, allowing on an average a return to work in the case of labourers, in from two to three months. In more advanced cases, with cavities and profuse expectoration, the results have been moderate.

Tuberculous laryngitis has been almost invariably benefited in a short time by intra-laryngeal injections of paratoxine, as the Professors call their product. Diarrhœa, even in the hectic stage, is greatly improved when paratoxine is given by the mouth. Hypodermic injection is the best method of administration, and has the great advantage of being quite painless. No toxic symptoms are produced.

Reviews of Books.

The Bacteriology and Etiology of Oriental Plague, By E. Klein, M.D., F.R.S., Lecturer on Advanced Bacteriology, St. Bartholomew's Hospital. Pp. xv + 301. London: Macmillan & Co. 12s. net.

Dr. Klein has written a book which, from the laboratory and bacteriological standpoint, will be of the greatest value, and those who may have to investigate suspected cases of plague bacteriologically, will find it a very useful handbook. The staining, cultural, and biological characters of plague are dealt with very fully, and this section contains the results of the author's experience in dealing with suspicious cases. Microbes simulating plague are discussed, and the characters of plague infection in rats and other rodents are described. As regards the author's views on plague conveyance, the flea theory is considered to be true only exceptionally, but it must be said that recent research is all in favour of it. The agglutination test Dr. Klein thinks is of value under certain conditions. A considerable section is devoted to a consideration of protective inoculation. The book is profusely illustrated with a number of beautiful plates, but lacks an index.

A Short Practice of Medicine. By Robert A. Fleming, M.A., M.D., F.R.C.P.E., F.R.S.E., Lecturer on Practice of Medicine, School of the Royal Colleges, Edinburgh; Assistant Physician, Royal Infirmary, Edinburgh. Pp. 748. London: J. & A. Churchill. 10s. 6d. net.

It is readily seen that this short manual has been written by a practical teacher, for it contains all the important points connected with the diseases with which it deals, and leaves out facts of less significance. It is evident that the book has been especially written with a view to aid the medical student in his study of medicine, and we can consequently confidently commend it to those who may be reading for their final examinations. As the book contains a *résumé* of all the most important facts in medicine, we believe that the busy general practitioner also will find it a useful volume to consult.

Heart Disease and Thoracic Aneurysm. By F. J. Poynton, M.D., F.R.C.P., Assistant Physician to University College Hospital, and late Sub-dean to the Medical Faculty of University College; Physician to Out-Patients, Hospital for Sick Children, Great Ormond Street. Pp. 310. Illustrated. London: Oxford University Manuals. 5s. net.

The arrangement of this work is rather better than that of the usual text-book on cardiac diseases. It treats very fully of the methods of examination as well as the pathology of the various forms of diseases of the heart, and lays the foundation for a correct differentiation and understanding of these conditions. We should, however, have liked to have seen more about the treatment. In medicine, at present, our powers of diagnosis are often excellent, but when we come to treatment—it is there we want help. It is our opinion that a much fuller explanation of the *rationale* of treatment

in cardiac cases would have added immensely to the value of a really good work.

Many pages on treatment might have been added without increasing the size of the book, if some of the illustrations had been omitted; as, although they are well reproduced, many of them are not necessary. The references to experimental pathology show how much medicine is indebted to this science in the study of cardiac disease. The book is well written and will take its place as one of the best text-books on the study of disease of the heart.

The Chemical Investigation of Gastric and Intestinal Diseases by the Aid of Test Meals. By Drs. Vaughan Harley and Francis W. Goodbody. London: Edward Arnold. 8s. 6d. net.

Drs. Harley and Goodbody have, in the short space of 261 pages, put before the student of gastro-enterology an excellent summary of the application of chemical methods to diagnosis.

These authors have not merely studied continental writers, and dished up in English form, as is too frequently done, what has been recently in fashion in Germany; but they have set out their own views on many subjects which, in the comparatively early stage of this branch of medical science, are naturally open to criticism from more than a single point of view.

In books on such subjects it is the author's views we want, and, in this instance, we have them. The work specially appeals to the trained laboratory student. Where read by intelligent practitioners of medicine, it must act in one of two ways:—where the reader is acquainted with chemical method, he will find most valuable suggestions, which cannot fail to give him a wider outlook on diagnosis:—where unacquainted with chemical method, it must teach him that anyone, who to-day attempts the investigation of gastric and intestinal conditions without such training, will inevitably fail. It is high time that the English medical practitioner paid some attention to a branch of exact science, which is being so largely utilised by his French, American, and German confrères.

The book is so good throughout that it is impossible to adversely criticise any section. But, if a suggestion may be made, we should like to see an entire chapter devoted to the dysenteries, and more upon the sections dealing with Functional Diseases of the Stomach, and the Examination of the Fæces.

Some Points in the Surgical Anatomy of the Temporal Bone, from Birth to Adult Life. By Arthur H. Cheatle, F.R.C.S., Aural Surgeon to King's College Hospital, and to King Edward VII.'s Hospital for Officers. Pp. 131. London: J. & A. Churchill. 5s. net.

The present work consists of the Hunterian Lectures, which were delivered at the Royal College of Surgeons in 1906. Throughout the book, Mr. Cheatle keeps in mind the practical side of pathology, and points out how age, to a very considerable extent, determines the course of disease of the middle ear. There are 112 excellent figures, which indicate that the author has industriously carried out the research, which has resulted in these Lectures, and the production of a work of a very high order.

Notes by the Way.

The Nobel Prize.

THE Nobel Prize for Medicine has been awarded, this year, to a French physician; and we congratulate Dr. Laveran on his attainment of an honour so very far from barren. His career, like that of Major Ronald Ross who received the prize in 1902, shows to what excellent scientific use the special experience of an army surgeon may be turned; and it is not necessary to explain that he was Major Ross's principal predecessor in the effective study of malaria. His opportunity came in 1878 when he was stationed in Algeria; and there, after patient and laborious research, he established the fact that the disease was not due, as had previously been supposed, to miasma, but to the presence in the blood of minute protozoan parasites. The discovery was made public in a lecture delivered before the Paris Academy of Medicine on November 23, 1880; and further investigations conducted by Dr. Laveran in Italy in 1882 indicated, if they did not demonstrate, the part played by the mosquito in the propagation of the malady. Subsequently, as if he aspired to proceed alphabetically through the long list of human ailments, Dr. Lavaran discovered a microbe believed to be responsible for mumps, and he is now working at the Pasteur Institute.

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Revivalism and Insanity.

THERE are some branches of medical science that they take more seriously in France than in England. One does not easily picture an English Government commissioning an alienist to attend Revival Meetings in Wales in order to study and report upon "the effect of mysticism upon mental maladies." The French Government did so, and the result is a most interesting and vivacious book by Dr. J. Rogues de Fursac entitled "Un mouvement mystique contemporain." On the whole the author seems to have found the Revivalists rather less mad than he expected, and comparatively little insanity traceable to their hysterical manifestations. There had been, indeed, in the asylums in which he made enquiries,

a small increase, in the year of the movement, in the number of patients suffering from religious mania; but this increase had been more than balanced by the diminution, during the same period, in the number of cases of alcoholic insanity. The conclusion would be more satisfactory were it not for the fact that, of the two forms of derangement, the former is much the more difficult to cure. A branch of the subject on which Dr. Rogues de Fursac failed to satisfy a very natural curiosity was the effect of the revival on the illegitimate birth rate. We do not ourselves know whether the figures are such as to warrant any inference; but risks of the character indicated are invariably present whenever young men and maidens are touched by the contagion of violent religious excitement. An historical instance is furnished by the case of the Genevan Revivalist, Donadille, of whom the Genevan historian, Picot, gravely records that he "was indiscreet in his manner with women under the pretext that he was inspired by God"; and every student of the phenomena of mysticism is aware of countless other examples.

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The Marriage of the Unfit.

In an address delivered at the opening session of the London School of Economics Dr. Westermarck stated the arguments in favour of the legal prohibition of the marriage of the unfit. Elaborating his views subsequently in an interview with the representative of a newspaper, he suggested that "a doctor's certificate of some kind should be required certifying the fitness of both parties to the union." Nobody can deny that the evil, for which he advocates this remedy, exists. We all know of cases in which unfit persons have married with results detrimental to the mental and physical health of the race. It does not follow, however, that this condition of things would really be mended by the adoption of the measure which Dr. Westermarck recommends; and there are several questions which it would be just as well for us to ask ourselves before deciding to support it. Is medical knowledge sufficiently advanced to enable doctors to pronounce an opinion that will be more than a conjecture on that vast majority of cases that would come before them? Could any Medical

Board define tests of fitness, that would exclude all the unfit without excluding a good many of the fit as well ? Supposing this difficulty to be surmounted, or ignored, would not means be found of evading a law so far in advance of public opinion ? Is there not a possibility, for example, that clever but unscrupulous men might lay themselves out to obtain medical diplomas for the sole purpose of enriching themselves by granting certificates for high fees in improper cases ? Would there not be a further possibility of vexatious litigation in cases in which certificates were properly withheld ? Finally, would not the refusal of certificates be thought, in certain social circles, to sanction the formation of illicit unions, and so increase, in an appreciable degree, the proportion of illegitimate births—a consequence that is well known to have resulted from the prohibition of marriage with a deceased wife's sister ? We have no space, in a Note by the Way, to attempt to answer any of these questions ; but it is worth while to address them to the enthusiasts who are so anxious to translate a pious, and no do doubt well-grounded, opinion into a law of the land. It often happens, as Herbert Spencer pointed out, that a law has unforeseen and unintended consequences of far more moment than the direct consequences contemplated by the legislator.

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Medical Inspection of School Children.

A MEMORANDUM of the Board of Education as to the medical inspection of children in the public elementary schools has been issued to the local authorities, and can, in its turn, be inspected. It will be seen that the so-called medical inspection is intended really to amount to a medical examination ; and it is clearly important that this examination should be conducted under conditions which will make it thorough and effective. This means, of course, that the work must be done by medical men, and must, on no account, and in no circumstances, be delegated to teachers or nurses. It means, too, that plenty of time must be allotted to the examination. Five minutes per child is the time suggested, but that is not enough. It would suffice to enable the physician to remark the obvious ; but a good deal of

mischief equally important, though less obvious, might escape his observation. Nor are we quite satisfied with the direction that the examination shall take place under the supervision of the Medical Officer of Health. Medical Officers of Health are appointed without special reference to their qualification for the discharge of the new duties which it is proposed by the memorandum to entrust to them; and a special appointment *ad hoc* might be expected to produce more satisfactory results.

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Inspection of the Home.

ANOTHER point. If the inspection is to fulfil expectations, the duties of the inspecting officer must not stop short at diagnosis, or even at prognosis. There must also be machinery for ensuring that the remedial treatment judged necessary shall be carried out. Authority must be vested in the inspecting officer to compel even the drawing of carious teeth that do not ache, and the washing of urchins whose parents are satisfied to see them dirty and verminous. The corollary of this proposition is, of course, that the medical examination, to be effective, must be extended to the children's home surroundings. This, it must be admitted, will be difficult, and indeed only partially possible — especially in the large centres of population. It will not only offend the ancient English doctrine that a man's house is his castle, and that, if he does not choose to clean it or open its windows, nobody has the right to tell him that he must; it will also hurt the sensibility of the poor, who resent the idea that a stranger should spy upon their poverty. However adroitly tact and firmness may be combined, these are obstacles which it will be difficult to surmount. It seems reasonable to hope, however, that something—and in some cases a good deal—can be done; and it is therefore imperatively urgent that something should be attempted.

Practical Notes.

EPIPHORA.—By this term is meant a flow of tears over on to the cheek, which is usually due to conjunctivitis, and associated with some imperfection of the drainage system, by means of which the outflow of the tears through the nose is retarded. The cause of the epiphora may, therefore, be in the upper or lower punctum, the canaliculi, the lachrymal sac, or in the nasal duct itself. The lower punctum may be misplaced, either by ectropion or entropion, consequently the tears cannot reach the punctum, but escape on to the cheek. It must be observed, however, that the lower punctum is more efficient than the upper for carrying off the tears. Epiphora may be due to blocking of the punctum by an eyelash or concretion, or swelling of the lachrymal papilla, associated with ciliary blepharitis, or a hordeolum, and sometimes the punctum itself is completely occluded. Obstruction to the canaliculi, especially the lower one, by concretions, a mass of streptothrix which is occasionally found in old people, or stenosis from previous inflammation, may cause epiphora. Acute and chronic dachryocystitis are usually associated with epiphora, as also is obstruction to the nasal duct in the nose. The obstruction to the nasal duct may be due to stricture, associated with swelling of the mucous membrane, which has originated in a catarrh of the nasal mucous membrane. It is a frequent accompaniment of syphilitic rhinitis, either congenital or acquired, associated with disease of the bones in the nose ; this is usually accompanied by ozena. Sometimes obstruction to the nasal duct follows injury, such as fracture of the bones of the nose and face. Epiphora is sometimes due to nasal polypi obstructing the nasal duct in the nose. One of the early symptoms of commencing obstruction in the tear ducts is that, when the eyes are exposed to cold, especially cold winds, the tears commence to run over on to the cheek. This is due to an increased secretion of tears, and the excess cannot escape by the normal method. It will hence be seen that epiphora is simply symptomatic, and that, when it occurs,

careful search must be made for the cause before the condition can be satisfactorily treated. In the majority of cases of epiphora, a swelling may be detected over the lachrymal sac, this should be carefully pressed. Should mucus or mucopus regurgitate through the puncta, the condition is one of chronic dachryocystitis, or mucocele, and the cause is either in the nasal duct, or in the lachrymal sac itself.

Lachrymation.—This usually implies an excessive secretion of tears which flow on to the cheek, and is due to the fact that the normal excretory passages are unable to cope with the increased flow. The usual cause of lachrymation is some reflex irritation occurring in connection with the eye itself, such as a foreign body in the conjunctival sac, usually to be found just beneath the upper lid, or embedded in the cornea. Lachrymation may be due, however, to affections of the cornea, such as corneal ulceration and interstitial keratitis. It may be due to the various forms of iritis, or iridocyclitis, and may be one of the earliest signs of sympathetic irritation. In all cases of lachrymation, therefore, the eyeball and conjunctiva should be carefully examined in order that the cause may be ascertained.

Acute Bronchitis.—This disease is one of the commonest sequelæ of measles and whooping-cough, and is a complication which must be carefully guarded against in children suffering from these affections. Persons suffering from bronchial asthma are particularly prone to acute bronchitis, and it frequently occurs at the onset of enteric fever and malaria. It is a disease which usually attacks young and old, and of the latter especially those who follow sedentary occupations. It is a common sequela of catching cold, and is really an extension downwards of a coryza. It is extremely common during the later winter and early spring months, and frequently occurs in association with cold east winds. The disease is most probably of microbic origin, and affects the mucous membrane of the larger bronchial tubes on both sides. The catarrhal inflammation may extend down to the smaller bronchial tubes or bronchioles, when the condition is known as capillary bronchitis; this is frequently followed by broncho-pneumonia. Patients suffering from acute bronchitis should be confined to

bed, and the temperature of the room should be kept at about 65° F., the air should be kept moistened with a steam-kettle, to which Tinctura Benzoini Co., or Eucalyptus, about 1 drachm to the pint of water, should be added. The bowels must be freely opened from the onset of the attack. The patient should wear a good knitted-wool vest, in order to keep the chest warm, which may be rubbed to advantage with a little Linimentum Terebinthinæ Aceticum. If poultices are applied, they must be hot and light, and, when they are changed, the chest must be carefully dried, and warm flannel applied. If these details are not attended to, the patient is extremely liable to take a fresh cold. Small mustard leaves are of service, but, if they are found to be too irritating, they should be covered in with silk before being applied to the chest. The skin must be stimulated to act, and sweating may be increased by hot baths. The following medicine may be prescribed with advantage:—

℞ Ammonii Carbonatis - - - gr. x.
Tincturæ Cardamomi Co. - - ʒss.
Inf. Caryophyl. - - ad ℥j.
Misce. Ft. Mist.
Two tablespoonfuls to be taken every four hours.

This medicine may be conveniently diluted with water.

The late Dr. Gustave Schorstein laid stress upon the value of large doses of ammonium carbonate in the treatment of acute bronchitis, recommending that as much as fifteen to twenty grains may be prescribed four times daily. If the pulse becomes weak, and respiration laboured, liquor strychninæ hydrochloridi should be given hypodermically. If the symptoms are not very severe, one of the following mixtures may be prescribed:—

℞ Vini Ipecacuanhæ - - - ♏vj.
Liquoris Ammon. Acet. - - ʒiss.
Spiritus Æth. Nitrosi - - - ♏xij.
Syrupi Tolu - - - - ʒss.
Aq. Camp. - - - ad ℥j.
Misce. Ft. Mist.

If the patient is a young adult, and the pulse full and strong, vinum antimoniale may be substituted for the vinum ipecacuanhæ in this prescription.

Two tablespoonfuls to be taken every four hours.

℞ Vini Ipecacuanhæ - - - ♏v.
Ammonii Carbonatis - - - gr. iij.
Spiritus Chloroformi - - - ♏x.
Tincturæ Hyoscyami - - - ♏xij.
Aq. Camph. - - ad ℥j.
Misce. Ft. Mist.

Two tablespoonfuls to be taken every four hours.

In some cases Dr. Schorstein recommended the administration of belladonna in combination with potassium iodide as follows :—

℞ Tincturæ Belladonnæ - - - ♏x.
Potassii Iodidi - - - - gr. iij.
Ammonii Carbonatis - - - gr. iij.
Potassii Bicarbonatis - - - gr. xv.
Aq. Camph. - - - ad ℥j.
Misce. Ft. Mist.

Two tablespoonfuls to be taken three or four times daily.

Cardiac Failure in Pneumonia.—In acute pneumonia, the second cardiac sound over the pulmonary artery is frequently found to be accentuated. This sign is a valuable one, and gives the practitioner an indication as to the condition of the pulmonary circulation. The pulmonary second sound becomes very much less distinct when the right auricle and ventricle become distended, and the right ventricle is unable to completely empty itself. As the right side of the heart becomes engorged, there is usually found to be an increase of the cardiac dulness to the right of the sternum. "With gradual heart weakness and signs of dilatation, the long pause is greatly shortened, the sounds approach each other in tone, and have a fœtal character (embryo-cardia)." Occasionally, as early as the third day in a case of acute lobar pneumonia, there may be a sudden and early collapse of the heart, the pulse becomes rapid and feeble, and there is an increasing cyanosis. For this cardiac failure in acute pneumonia, the following may be prescribed :—

℞ Tincturæ Nucis Vomicæ - - ♏vj.
Tincturæ Digitalis - - - ♏v.
Spiritus Ether. Sulph. - - ♏xij.
Spiritus Ammon. Aromat. - - ♏xv.
Inf. Cinchon. - - ad ℥j.
Misce. Ft. Mist.

Two tablespoonfuls to be taken every six hours.

In some cases, the cardiac failure is due to the paralysis

of the vaso-motor centre, which is situated in the lower part of the floor of the fourth ventricle, and there is consequently a general fall of arterial blood pressure ; this is due chiefly to the action of the toxin upon the nerve centres. In this condition, the pulse becomes soft and easily compressible, the facies gray, the hands and feet cold, the skin bathed in a cold sweat, and there is a progressive prostration.

CHILBLAINS.—As a rule, those who suffer from chilblains have a somewhat feeble circulation, and the indication, therefore, is to administer tonics such as Syrupus Ferri Phosphatis Co., Maltine, or cod-liver oil. Recently, it has been recommended that some of the soluble salts of calcium should be prescribed, in order to increase the coagulability of the blood, and, with this in view, the lactate or chloride of calcium may be given three times daily. The following may be prescribed :—

℞ Calcii Lactatis vel Chlorid. - - gr. x.
Syrupi Aurantii - - - ♏xxv.
Aq. - - - - ad ℥ss.

Dr. Robert Hutchison recommends the following local applications :—

℞ Potassæ Causticæ - - ½ %
Glycerini - - - - 20 %
Alcohol - - - - 20 %
Aq. - - - - - 60 %

Ft. Lotio.

The hands are to be bathed in water, and this lotion rubbed in ; or,

℞ Linimenti Aconiti - - - ℥iss.
Linimenti Belladonnæ - - ℥iss.
Tincturæ Opii - - - ℥iij.
Olei Amygdalæ - - - ♏v.
Linimenti Saponis - - ad ℥ij.

Ft. Lin.

About ½ to 1 drachm is to be applied to the painful part night and morning.

THE PRACTITIONER.

MARCH, 1908.

THE AORTIC INCOMPETENCE OF LATER LIFE.

By SIR JOHN F. H. BROADBENT, Bart., M.A., M.D., F.R.C.P.,

Physician to Out-patients, St. Mary's Hospital; and Assistant Physician to the London Fever Hospital.

When we have to give an opinion on a case of aortic regurgitation, the result of acute endocarditis in a young subject, we are able, from the degree of collapse in the pulse, the amount of hypertrophy of the left ventricle, and the character of the symptoms, to form an estimate of the extent of the lesion, and to give a fairly accurate prognosis as to the future.

It is otherwise with the lesions of the aortic valves established late in life, which are not due to acute endocarditis, but are the result of chronic degenerative change, affecting not only the valves but also the arch of the aorta or other structures. Here the incompetence of the valves may be the least serious of the dangers that threaten the patient, and we have to take many other factors into consideration.

Acute endocarditis does, of course, occur in later life, but, in my experience, the simple rheumatic form is rare, and the malignant or infective variety is far more commonly met with. The aortic valve is also the valve most frequently attacked, and is sometimes the seat of previous degenerative change and calcification. The onset of the disease may be very insidious; the temperature may be little above normal, with periods of complete apyrexia, and, in some instances, no diastolic murmur may be audible throughout the illness, though large fungating vegetations in the aortic valves are revealed at the autopsy. In others, though a diastolic murmur is present, there may for many weeks be no definite indication of the serious nature of the affection except periods of moderate pyrexia. In these cases the increased frequency of the pulse rate, ranging from

84 to 100, which does not fall to normal even with prolonged rest in bed, should put us on our guard. Progressive anæmia and asthenia, dyspnœa on slight exertion, gradual loss of flesh, without obvious cause, attacks of pain in the region of the spleen, and enlargement of that organ suggestive of infarction, should further arouse our suspicion. Sooner or later, as a rule, the pyrexia increases, and assumes the septicæmic type, the temperature rising to 103 or 104 at night, and falling to 99 or normal in the morning, and there can then be little doubt as to the diagnosis. Examination of the blood for micro-organisms will usually yield positive results at this period, but is not so successful in the earlier stages, as the organisms do not appear to be always present in the blood stream.

I have interpolated this section on acute endocarditis, as it may be one of the causes of aortic incompetence in later life, but I purpose in this communication to deal rather with chronic degenerative lesions of the aortic valves, and shall not again refer to the subject of acute endocarditis.

Among the causes of degenerative lesions of the aorta, which may affect the aortic valves, and give rise to aortic regurgitation in later life, are the following:—

1. Senile degenerative change.

2. High arterial tension or constant undue strain on the valves and arch of the aorta. This may be the result of lead poisoning, over-eating and drinking with imperfect elimination, or be associated with gout, rheumatoid arthritis, or diabetes. In all cases heredity is an important predisposing factor.

In this connection, the experiments of Josué, in 1903, in which he produced degenerative changes in the aorta of rabbits by repeated injections of adrenalin, are of importance as showing that increased blood pressure may effect this. These experiments with adrenalin were repeated by Fischer, in 1905, and he produced in addition aneurysm of the aorta, and obtained similar results with digalen. Rickett,[1] in a paper recently published, confirmed the results of Josué and Fischer, and experimented further with Squill, Barium Chloride, and Nicotine, which also caused a rise of blood pressure and lesions of the aorta. He came to the conclusion that the damage to

[1] *Journal of Pathology and Bacteriology*, October 1907.

the aorta was mainly due to the increased blood pressure, induced by adrenalin and substances with similar physiological action, and not to a specific toxic action of these drugs on the vessel wall.

It is remarkable that, in chronic interstitial nephritis, in which the blood pressure is higher, as a rule, than in any other affection, aortic incompetence and degenerative change in the aorta are seldom met with. The explanation may be that, as the increase in blood pressure in this affection is gradual, the vascular system has time to adapt itself to the increased strain by hypertrophy of its muscular coat, or that cerebral hæmorrhage, or death from uræmia, occurs before degenerative changes in the aorta and its valves set in.

3. *Severe intermittent strain* on the valves from frequent and violent fluctuations in the blood pressure. Such fluctuations, as originally pointed out by Clifford Allbutt, occur in the case of men following certain arduous occupations, such as those of miner, collier, hammerman, grave-digger, bricklayer, &c., which entail severe exertion, and a series of physical efforts frequently in cramped positions.

Repeated and violent fluctuations in the blood pressure are, I think, a more important cause of degenerative change in the aorta and its valves than high arterial tension, for they do not induce a condition of hypertonus of the vascular system, or hypertrophy of the vessel walls, which is to a certain extent protective, and the damaging effect of intermittent strain is greater on relaxed vessels than in vessels maintained in a condition of tonic contraction. We have evidence of this in the elongation and tortuosity of the brachials and larger vessels of the lower extremity which is a marked feature in these cases.

4. *Syphilitic Aortitis.*—Syphilis has been long recognised as a cause of degenerative lesions of the aorta and aneurysm. The ascending aorta is most commonly affected in the immediate neighbourhood of the valves, and aortic incompetence, with general dilatation of the aorta, is not infrequently a precursor of aneurysms. Syphilitic aortitis is characterised by endarteritis obliterans of the vasa vasorum and cellular infiltration in their neighbourhood. The destructive process is most evident in the outer layers of the media, and vessels

may be seen, in some cases, penetrating far into its substance. There is usually also scarring and proliferation of the endothelium.

The base of the valves may be affected so that they become thickened, inelastic, and puckered, and leakage occurs; or incompetence may result from dilatation of the weakened and diseased aorta to which they are attached.

5. *Rupture of a Valve.*—This is of very rare occurrence and can only happen as a result of sudden strain in a valve previously damaged by endocarditis.

PHYSICAL SIGNS.

Pulse.—The radial artery is usually thickened; the brachials are thickened and tortuous, and thrown into curves at each pulsation, more especially in those cases in which the degenerative change is the result of arduous occupation associated with violent fluctuations in the blood pressure.

The pulse wave is sudden, forcible, and short, but the vessel does not empty between the beats, and there is not the collapse that is present in cases of rheumatic origin. The difference is well brought out by a sphygmographic tracing.

Blood Pressure.—There is some difference of opinion as to the blood pressure in aortic regurgitation, which probably arises from not differentiating between cases, in which the incompetence is the result of degenerative change, and those in young subjects, in which it is the result of acute endocarditis. In tbe former, the blood pressure is, as a rule, comparatively high, in the latter, the converse. A simple illustration will explain why this should be so.

If we have a fire hose with a pump at one end and a nozzle at the other, the mean pressure of the contained fluid and the strain on the hose pipe will be greater in proportion as the nozzle is narrow and more resistance is offered to the outflow.

If the valve of the pump leaks so that fluid regurgitates, the mean pressure between the strokes of the pump will be lower in proportion to the amount of leakage.

In aortic incompetence, due to acute endocarditis, we have dilated, enlarged, and relaxed vessels, and low peripheral resistance, corresponding with a wide nozzle, and frequently a

considerable degree of regurgitation in addition, so that we have not the conditions for maintained high pressure between the beats, and, in this group of cases, I have found it as low as 90 m.m. and seldom higher than 120 m.m. as estimated by the Riva Rocci instrument.

In the aortic incompetence of later life, high blood pressure, constant or intermittent, as has been already stated, in a large proportion of cases, has preceded, and has been responsible for, the giving way of the valves. In these cases, in which arterio-sclerosis is usually a marked feature, the peripheral resistance is necessarily high, and we thus have conditions corresponding with a narrow nozzle. The leakage, moreover, through the valves is usually small in amount. We have, therefore, the necessary conditions for high blood pressure, and, in a series of cases estimated by the Riva Rocci instrument, I have found it to vary from 150 m.m. to 180 m.m.

If the regurgitation is considerable in amount, compensation will fail as the left ventricle in advanced life is unable to hypertrophy and adapt itself to the extra strain. In this event, the blood pressure will be necessarily lower, not only because of the leakage, but also because the reduced power of the heart beat or strokes of the pump.

The Heart.—The left ventricle is usually hypertrophied to a moderate degree. The degree of hypertrophy seldom approaches that met with in aortic incompetence, the result of rheumatic endocarditis in a young subject, as the heart is incapable of efficient hypertrophy at the advanced period of life at which this affection occurs. The hypertrophy, which exists, is usually the result of the high arterial tension which has preceded the onset of incompetence. If the regurgitation is at all considerable, the left ventricle gives way under the strain. The apex beat will usually be in the fifth or six space ½ inch to 2 inches outside the nipple line, and will be moderately forcible and somewhat diffuse.

The diastolic murmur is audible, as a rule, at the aortic cartilage, but is often more pronounced at the third or fourth left costal cartilage, or over the sternum, and may be conducted to the apex.

The reason for this conduction of the murmur would appear to be as follows :—The aortic valves lie just behind the lower

border of the third left costal cartilage close to the sternum. One might expect that the aortic second sound could be heard at this spot, but between the aortic valves and the chest wall is interposed the conus arteriosus of the pulmonary artery, which interferes with conduction. The second sound is, therefore, best heard at the second left costal cartilage, being conducted upwards in the direction of the blood stream to the part where the arch of the aorta comes into immediate relation with the chest wall. In aortic incompetence, the regurgitant stream is directed backwards through the valves, so that the vibration or murmur thus generated is conducted downwards towards the ventricle rather than upwards. That the direction, in which it is conducted, is influenced by the regurgitant blood stream, seems to be supported by the fact that systolic aortic murmurs are best heard at the aortic cartilage.

The aortic second sound is not replaced by the murmur, but is, as a rule, low pitched, loud, and ringing, or booming in character. This is quite distinct from simple accentuation, and, when present, is indicative of dilatation of the aorta, which is frequently associated with, if not actually the cause of, the incompetence of the valves.

SYMPTOMS AND COURSE OF THE DISEASE.

The symptoms vary greatly in different cases, as they are not always attributable to the aortic lesion, but may be partly due to degenerative vascular lesions elsewhere. When the aortic lesion is the result of intermittent strain, associated with arduous occupations, it is apt to be progressive, and when the regurgitation is at all considerable in amount, compensation usually breaks down rapidly as the left ventricle in later life is unable to take on efficient hypertrophy. Hence results secondary mitral incompetence, back working through the lungs with cough, dyspnœa, and perhaps cyanosis from pulmonary congestion. The right ventricle is unequal to the strain, so that enlargement of the liver, fulness of the veins of the neck, and œdema of the legs supervene, and death results from heart failure.

The following case may be quoted in illustration :—

F. S., aged 48, a road maker, was admitted to St. Mary's Hospital, on August 7, 1907, when I had charge of the wards. He had had pain in the

chest and increasing dyspnœa for the last month, but had continued to work up to date of admission. There was no history of syphilis. On admission pulse 88, sudden short wave. Heart, apex beat in fifth space, in nipple line, moderate force. There was a systolic and diastolic murmur at the apex, and a long blowing diastolic murmur at the aortic cartilage conducted down the sternum. The liver was greatly enlarged and tender, reaching down to the umbilicus. Temperature 98·4. Orthopnœa. The pulse became irregular, the mitral systolic murmur more pronounced, the dyspnœa more severe, and he died, on September 7, from heart failure just a month after admission.

Sudden death may occur from syncope in these cases, even before pronounced symptoms of failure of compensation are present, as in the following case :—

C. S., a gravedigger, aged 49, came to my out-patient department at St. Mary's Hospital, in September 1905, complaining of shortness of breath and cough. He had been a gravedigger for 26 years, and had been at work till six months ago. The pulse was sudden, and the wave short, the radial artery was thickened, and the brachial arteries were tortuous, thickened, and thrown into curves at each beat of the pulse. The heart was moderately hypertrophied. There was a diastolic murmur at the aortic cartilage, and the second sound was low pitched and ringing in character. A systolic murmur was audible at the apex. He improved somewhat at first under treatment, but the dyspnœa on slight exertion persisted. The liver was not enlarged, and there was no œdema of the legs. In December, he had an attack of bronchitis, and became somewhat cyanosed, but this cleared up, and he was able to get about again ; but he died suddenly, on January 28, from a syncopal attack.

Aneurysm.—When the incompetence is so slight as not to cause any serious embarrassment of the heart, aneurysm is one of the dangers to which the patient is exposed from the progress of the degenerative change. I have seen two instances, in which an aneurysm developed while the patient was under observation. The following is a case which I had the opportunity of watching for upwards of three years, on and off :—

The patient was a man, aged 49, a bricklayer by trade, who had been doing heavy work for some 25 years. When first seen, in 1903, there was a diastolic murmur at the aortic cartilage with a ringing low-pitched aortic second sound. The brachials were thickened and tortuous, and the radial artery was thickened, the pulse-wave was sudden and ill-sustained, but not collapsing, the heart moderately hypertrophied. His condition remained much about the same till March 1906, when he developed ascites, and was tapped several times during the next three months. In May of the same year, after going away to a convalescent home, he returned much worse, with a cracked voice, and was very short of breath. On examination, the left vocal cord was found to be paralysed. This was the first symptom

of aneurysm. The aneurysm extended rapidly, and, in August, a pulsating tumour appeared to the left of the sternum in the second left intercostal space. This gradually enlarged, and there was dulness to the right of the sternum, though no pulsation. In September, the veins of the arms and of the neck became distended and full, and the latter did not empty on deep inspiration, indicating pressure on the superior vena cava.

Shortly after, the veins in the front of the chest became prominent and distended, and the internal mammary veins anastomosed with the superficial epigastric veins, the current of blood being downwards, This was a further indication of pressure on the superior vena cava, showing that, in consequence of the return of blood to the heart by this channel being obstructed, it was finding its way round by these anastomoses to tributaries of the inferior vena cava.

On October 19th, 1906, he died suddenly from rupture of the aneurysm into the trachea.

Post-mortem, a large aneurysm was found involving nearly the whole of the transverse arch of the aorta, compressing the left recurrent laryngeal nerve. There was a sacculated projection to the left of the ascending aorta, over which the superior vena cava was stretched and flattened. It was not entirely occluded, but the obstruction to return of blood to the heart by this channel must have been very considerable. The aortic valves were thickened, rigid, and incompetent.

Symptoms of a urœmic character, dyspnœa without any evidence of pulmonary congestion, but rather of the nature of air-hunger, termed by Huchard, "*dyspnée ioxi-alimentaire*," and a noisy delirious condition at night, are met with in a certain proportion of cases. Headache and vomiting are, however, not present, as a rule.

These symptoms are attributable to renal insufficiency, even though neither albuminuria nor dropsy may be present.

Here it would seem, from the microscopic appearances, that degenerative changes have especially affected the renal vessels, and that the imperfect supply of blood through the thickened inelastic atheromatous vessels has led to atrophy of the renal epithelium, more especially of the convoluted tubules, and consequent retention of toxic products, which are responsible for the uræmic symptoms.

Angina pectoris is sometimes a distressing feature. When present, it is probably due to obstruction of the orifice of one of the coronary arteries by an atheromatous plaque, or as the result of subacute aortitis. It is, however, not very common, and occurs more often in cases of aortic stenosis, or of incompetence and stenosis combined, the result of rheumatic endocarditis.

PROGNOSIS.

The prognosis is, in my experience, uniformly unfavourable. The one exception, perhaps, is, that in which the incompetence is the result of senile degenerative change. One case of this nature, a woman, aged 73, I have had under observation for upwards of two years, during which time the lesion does not appear to have progressed, or to have given rise to any serious symptoms.

In all other varieties, the lesion is apt to be progressive, and when the regurgitation is at all considerable the left ventricle is unable to cope with it, and the heart gives way under the extra strain, as already described.

Sudden death is particularly liable to occur even in the absence of any warning symptoms such as angina pectoris.

As has already been pointed out, in addition to the valvular lesion, degenerative changes in the aorta, coronary arteries, heart, and kidneys, are possible sources of danger which must be borne in mind when we attempt to forecast the future in these cases.

TREATMENT.

The treatment will vary according to the predominant symptoms.

If uræmic symptoms predominate, such as dyspnœa, delirium, and restlessness, the administration of mercurial purgatives, mild diuretics, and iodides will be beneficial. Most important of all, however, is a purin-free diet, and an absolute *régime lacté*, as advocated by Huchard, may be advisable in some cases.

If anginoid symptoms are present, the administration of trinitrin, amyl nitrite, sodium nitrite, or other vaso-dilator will be called for. Morphia given hypodermically will often afford great relief, both in these cases and in the group mentioned above.

The question as to the use of digitalis in aortic incompetence has been much debated. In cases due to degenerative change, it is seldom called for, as the blood-pressure is usually high, and the regurgitation inconsiderable. Even when the incompetence appears to be giving rise to cardiac embarrassment, the object of treatment will be rather to relieve the

left ventricle by lowering the blood pressure, than to attempt to stimulate it.

If, however, compensation, has completely broken down, and mitral imcompetence is present, with engorgement of the lungs and back working, so that the work of compensation falls on the right ventricle, digitalis may sometimes prove of service in stimulating and reinforcing the embarrassed right ventricle. It is, however, not always beneficial even in these cases, as the right ventricle may be the seat of fibroid change, or be incapable of responding efficiently.

In similar conditions in young subjects, in which the incompetence is the result of acute endocarditis, and secondary mitral symptoms are present, the benefit from digitalis to the right ventricle may be very marked, and efficient compensation be restored for a time, as the heart muscle is usually healthy, and responds more readily to stimulation.

The effect of the digitalis will, of course, not be confined to the right ventricle, and its action on the left ventricle may up to a certain point be beneficial in helping to restore it to its previous state of efficiency.

Digitalis should, however, not be employed even in young adults, still less in later life, in aortic incompetence, unless there are mitral symptoms in addition, as described above, as unnecessary stimulation of the left ventricle will only cause a more violent and forcible contraction, which will project the blood into the aorta with greater force, and throw more strain on the vascular system, but will in nowise diminish the amount of regurgitation.

APPENDICITIS.[1]

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Quite recently letters and articles have appeared in the public press, written ostensibly by medical men, which, whilst they pretty accurately voiced the general lay opinion which is being formed, showed sufficient want of acquaintance with the actual facts of the case, as to justify some attempt being made to put in a clearer light what is known about appendicitis and its treatment.

During the last few months I have questioned all the medical men to whom I have had access as to their experience and opinions with reference to this complaint, and these include most of the best known operators, and every general practitioner whom I have met, whose testimony, as being that of the men who first see these cases, and have the charge of them in after years, is frequently as valuable as that of the surgeons who operate.

And the combined result appears to be this: there exists, at present, a widespread belief that in appendicitis we have an extremely dangerous and treacherous complaint, the course of which cannot be predicted in any given instance; that the most simple may have, without warning of any kind, a fatal ending; that medicine and nursing are alike powerless against it; that, when once abdominal pain, becoming localised in the right lower quadrant, vomiting, and rise of temperature occur, there is no safety for the patient, or equanimity of mind for the surgeon, until that abdomen has been opened and the appendix removed; that at any moment, and in every case, gangrene or perforation may occur, and the whole abdominal cavity be flooded with pus, or other intensely poisonous material. Every case should, therefore, be operated upon as soon as seen, should, as it were, be shot on sight.

I venture to enter a modest, but not the less firm, pro-

[1] Post-Graduate Lecture delivered at Ancoats Hospital.

test against this view. I should have done so with more trepidation, I confess, had not Mr. Paul, in his address to the Liverpool Medical Institute, already sounded the same note with more force than I can hope to use, and had not Mr. James Berry, in the *Lancet* of September 7, expressed a similar opinion. But the number of those bold enough to contest the prevailing idea is but small, and I may at least hope to strengthen it.

Those who hold the view which I have enunciated in its entirety are, I submit, too ready to generalise. To them the word "appendicitis" conveys, or appears to convey, but one idea. Every case is, when once labelled, equal to every other in anatomy, pathology, and potentialities of evil result; they should therefore be treated in precisely the same way, and, as a natural corollary, every surgeon or practitioner who does not immediately attack it surgically is guilty of criminal negligence. That is the view one hears most often expressed, and, as is but the natural result, that is the view which the general unscientific public are rapidly adopting.

But surely a little consideration will convince every thinking man, who has had any experience of this work, that all this is not a complete statement of the facts, and that there is room, and indeed pressing need, for some discrimination.

One of the most, perhaps the most, important of all the lines of differentiation, is that of previous history; there exists one large class in which a clear account of one or more previous attacks is available, and another in which no such history can be obtained. Now gangrene and acute perforation, those two bugbears of the whole subject, are not processes which die down when once they are started. A man, who has an appendix threatened with gangrene, does not have a quiescent period of months or years before it becomes dangerous. The thing once begun goes on to a finish. So that, if there is a history of two or three previous slight attacks, gangrene of the appendix may be ruled out. Acute perforation, to be immediately dangerous, must open directly into the peritoneum; if, during several previous attacks, protective adhesions have been formed over and around the weak spot, the bowel may perforate, but it will be into a cavity,

already walled off in a way far more secure than can be imitated by gauze packing, however scientifically placed; and, conversely, those cases which entail a tedious and difficult dissection, in consequence of firm adhesions around, do not acquire those adhesions in three or four days, so that we are not likely to be obliged to expose patients, who have had no previous attacks, to a prolonged and difficult operation at a time when speed is above everything else important. Epigrammatic utterances in surgery are always to be regarded with suspicion, and the man, who laid down as the primary rule in operations for appendicitis the oft-quoted phrase, "Quick in and quicker out," could only be thinking of operations in acute or fulminating appendicitis; he could have had but little or no experience of cases, in which "Quick in" would mean almost certain injury to the adherent bowel below the abdominal wall, and "Quicker out" would necessitate the leaving of some part of the inflamed, adherent, and abnormally placed appendix behind. In either case, I think it would be safe to say that the patient would have fared better if he had never seen that particular surgeon.

For the difficulties encountered in some operations are very great: never insurmountable, if the surgeon is not driven by an excessive rage for speed, or by the urgent necessity for rapidity, which always exists when interference is attempted at the height of an attack, but entirely impossible to be effectively dealt with, when each moment means increased strain upon the greatly weakened resistive powers of the patient. Each additional disturbance of the parts means increased danger of infection by fresh and unprotected layers of absorptive tissues. The appendix is not always found "floating loose in a pool of pus." It is not always easily found at all. The first incision does not by any means always discover the—sometimes—multiple abscess cavities. When those cavities have been reached, the inner boundary, which shuts them off from the previously uninfected peritoneal cavity, may be extremely thin, and only too easily damaged by the exploring finger or instrument. Should such damage be done during an acute attack, germs which possess, at such a time, their greatest virulence, will be set free to infect the general peritoneum, at a time when the opsonic index of the

patient's resistance is at its lowest, and the damage may be so situated as to be unnoted, or even undiscoverable, by the surgeon. It must be remembered that it does not need a breach of any size to permit the passage of micro-organisms, or the toxins they produce. If the appendix is buried in the ilio-cæcal pouch, for instance, its tip may lie immediately below the peritoneum inside the ilio-cæcal valve. Entrance to the pouch may be easy or difficult, but when the surgeon begins to withdraw the diseased structure, the adherent tip will drag downwards with it a funnel-shaped prolongation of the peritoneum. At the height of the inflammatory attack, the tissues are soft and easily torn. When the appendix is nearly withdrawn, just as the tip makes its appearance, the strain upon the tissues becomes too great. Either the peritoneum gives way around the adherent tip, or that structure itself tears through. The bulk or the whole of the appendix comes away, but the tissue, which has been loosened from it, retracts immediately out of sight and reach, with an opening in it, by which access has been obtained to the general peritoneal cavity, and this opening cannot be seen, covered as it is by the ilio-cæcal junction. Even if it could be seen, and could be sutured, what are the suture openings but additional paths for infection? It must always be remembered that the peritoneum itself, however thin, is, if uninjured, the best possible barrier to infection from without.

Cases, in which there has been failure in removing all the diseased tissue, do not, as a rule, find their way into the literature, and I have searched in vain for an example of what all operators know does occur from time to time. I am compelled therefore to use a hypothetical case, although it may not carry so much conviction to the minds of my hearers.

A woman, age about 30, had had repeated attacks of appendicitis for five years; the first attack was evidently catarrhal, and, as it occurred five years ago, was treated by her medical attendant in accordance with the doctrines which obtained at that time, when surgical interference was looked upon as only very exceptionally required. She was kept in bed, hot fomentations applied, very little food given, a little morphia used when the pain was severe, and, in due time, she recovered.

For over a year, there was perfect health, then she had another attack. Encouraged by the success of the previous treatment, it was repeated, and once more the pain passed off, the vomiting ceased, the temperature returned to normal, and she resumed her household duties, apparently quite well. This state of things lasted for nine months, when she again suffered in the same way, and was treated as before. This time she had eighteen months freedom, and congratulated herself and her medical attendant upon an apparent cure. Her doctor was a man of fifty years of age, and wishful to retire from practice. He took, as partner, a younger man, who had been trained in the later ideas, and was very up to date in all ways. When this patient again developed symptoms of appendicitis, as she did, the junior partner saw her, and immediately suggested operation, but was overruled by his senior, and, with the concurrence of the patient, who dreaded the idea, and besides had the knowledge that she had already passed successfully through three similar attacks, she was treated as before, and again returned to her normal state of health. During the interval that followed, the senior partner died, and his junior took up the practice entirely. Being an energetic and enthusiastic man, he had attended, whilst his partner was alive, certain post-graduate lectures, in which the question of appendicitis had been discussed by one of the staff of the hospital in that city, who was strongly in favour of immediate operation in all cases. This surgeon, one of the smartest of the day, had brought forward case after case of general suppurative peritonitis following delay, and had succeeded in impressing his class with the awful possibilities which surrounded any treatment but that of surgical interference. He had done this in all good faith, but his experience being almost entirely gained in hospital and in consultation, he had only come into contact with the worst cases, and, if the differentiation, which I have suggested, had occurred to him at all, he had dismissed it without much consideration, believing that the dangers of delay quite overshadowed anything else. The effect upon the junior partner had been great. Previously inclined in that direction, he was now fully convinced, and determined that no case of his should run such risks. Fortified by the opinion of a man, for whose reputation he had a great

respect, he looked out eagerly for an instance in which he could carry out this advice. Whilst in this mental condition, he was summoned by his old patient, in whom another attack, and perhaps a slightly more severe one, had commenced the night before. Here was the opportunity he had been seeking. He had proposed an operation before, but had been overruled. This time no such mistake should be made. Fresh from the dreadful experiences, which he had heard recounted, he described the dangers of delay and the triumphs of present-day surgery to his patient and her friends in such a way that they became almost as eager as he to adopt this certain method of saving her at once from a dreadful death, and of putting an end to these recurrent illnesses. The surgeon was sent for and agreed to operate. Hurried preparations were made, and the operation commenced. The patient's temperature at the time was 103, and her pulse 120. The junior partner's mind was filled with visions of a large abscess on the point of bursting into the peritoneal cavity and possibly of a gangrenous appendix, and watched eagerly for the escape of the pent-up fluid. When, however, the peritoneum was opened, no such flow appeared; instead the reddened and vascularised cæcum was seen; curiously enough too, at first sight there seemed to be no appendix, the cæcum appearing to end blindly. By following the longitudinal band downwards, in a few moments, the commencement of the appendix was found, but the rest of it evidently lay behind the colon, which was itself bound down to the iliac fossa by dense adhesions. These were divided, and the colon bit by bit turned inwards. In doing this, the operator came upon a small collection of pus, which was intensely offensive. On clearing this away, fæces appeared coming from an opening in the posterior wall of the gut. Just at this moment, the chloroformist hinted strongly that the patient's condition was becoming very bad, and that it would be well to cut the operation as short as possible. The surgeon made a further attempt to free the remainder of the rotten appendix, but it tore through a little further on leaving a portion of its extremity behind. The appendix had still to be separated from the cæcum, and the opening in that viscus to be closed. There was evidently but little time for anything else. This then was done as quickly as possible, and a suture was placed around

the tear in the colon. During this last manœuvre, the chloroformist became very insistent, and this was therefore done hurriedly. The operator could not feel secure that this opening was safely obtunded. A drainage tube was therefore passed down to this point, and the abdominal wall closed by the most ready method, through and through suturing. When the patient was returned to bed, she was greatly collapsed, and the pulse almost imperceptible, but, by the use of stimulants, hypodermic injections of strychnine, and transfusion, the collapse passed off, and she slowly recovered, having, however, a fæcal fistula at the point where the tube had been placed, from which fæces flowed pretty freely. A long convalescence followed. When once more fit for surgical interference, an attempt was made to close the fistula, but fistulæ of this kind are not so easily closed as they are made ; the parts were much matted together, and the opening in the bowel being behind was not easily reached ; the appendix tip could not be found amongst the dense scar tissue, and, when the wound was once more closed, the operator had the feeling that, although he had managed to pretty thoroughly close the opening in the bowel, the pus from the appendix would, in all probability, convert his sutures into setons, and so bring about fresh escape of fæcal material ; and so it proved. At first the operation appeared to be successful, but later the wound broke down, and the previous fæcal fistula was re-established. The friends of the patient lost confidence, and removed her to London, where two more operations were performed for this purpose by a surgeon in that city. After the second, the patient died.

Now this case, although hypothetical, is based upon actual facts within my knowledge, and might indeed happen to any operator, who allowed himself to be biassed by the prevailing opinion that, in all cases, operation should immediately follow diagnosis, and its lesson is no less plain. In cases, in which the history of previous attacks renders it probable that many adhesions will be found, or that tedious and careful dissection will be required, it is wisest to choose a time for operation, when the patient's condition will permit of the careful and thorough performance of the necessary work, and such a time is not during the height of an acute attack, when the surgeon will be driven by the conditions present to shorten the duration

of his interference to the smallest possible ; for, at no future time, will he find the parts so easy to dissect, so capable of recognition as at the first attempt.

But all the conditions are altered when once the attack is over and a quiescent period reached ; the germs have lost their intense virulence ; many, if not most of them, are dead. If a few gain admission to the peritoneum, that membrane can now deal easily with their attenuated force. Wright has shown that, after an attack of this kind, the opsonic index rises ; the patient's resistive powers are at their highest, or are steadily increasing ; the patient is, in fact, inoculated against it, and the effect of such inoculation lasts for a certain period during which he or she is more immune against that particular infection than before. Such an operation may now be done safely and methodically, the entire structure safely and certainly removed, and all needful work once and for all finished.

This is the position with reference to cases, which possess a history. In them we are not likely to encounter gangrene or acute perforation. If perforation of the appendix takes place, it will be into a cavity already well shut off by adhesions. During the acute stage, the virulence of the micro-organisms is at its highest, the development of antitoxins and opsonins at their lowest. The system of the patient, as a whole, is at its worst for operative purposes, and the surgeon who interferes at this time may extremely easily do far more harm than good by destroying some effective though delicate adhesion, or by opening a way into the peritoneum which had up till then confined the struggle between the two combatants, the microbes and phagocytes, to safe limits. The prospects of the fight were good before for the patient ; the powers, both of the invading and the defending army, had been tried before and the latter had been proved to be the stronger ; the relative value of the factors was not unknown as in the other class of cases. If disaster should follow the hasty action of the surgeon, as it frequently has, he will be in the position of Romeo after the fight between Mercutio and Tybalt ; as Mercutio is assisted home, he turns on Romeo with the disgusted exclamation, "Why the devil did you come between us ? I was hurt under *your* arm," and Romeo can only make the weak reply, "I thought all for the best." If Romeo had had previous

experience of the respective fighting powers of Mercutio and Tybalt, and had seen Mercutio easily and repeatedly the victor, I do not believe that even that impulsive young man would have meddled.

Just so I hold that it is wisest in such cases not to meddle if it can be avoided, but to wait for a quiescent period; and that the question as to whether it is wise to wait in any individual case can only be settled by a surgeon of experience in such work, and not by any hard-and-fast rule.

But matters are entirely different in cases with no history. In these we have no previous knowledge as to the relative value of the forces engaged. We cannot gauge the virulence of the micro-organisms or the power of the resistive forces. In such cases there can, I think, be little doubt that operation, if only to ensure thorough drainage at the earliest possible moment, is the only wise course. We are not likely to meet with dense adhesions; there has not been time for their formation; but at the same time too great care cannot be taken not to attempt too much at this time; if the appendix is easily and quickly accessible, it may be taken away, but even this is risky; the tissues of the cæcum are softened by inflammation, and the sutures, introduced with a view to close the opening in it after the appendix is gone, may tear out, in which case the opening is made larger, and the risk increased. Any radical procedure had better be left until the force of the attack is spent and the patient convalescent; it may then be done with safety. The mortality of an appendicectomy, during a quiescent period, in expert hands is nil; that of operations, during an acute period, is anything from 25 to 75 per cent. That is a fact never to be forgotten.

There is no doubt that, in earlier days, we erred from the same cause, want of discrimination. We erred then in leaving all cases in the hope that a quiescent period might arrive. Grave disaster followed this policy. Many lives were lost in primary cases, which are now saved by earlier drainage, but the pendulum is in danger of swinging too far in the opposite direction, and especially amongst young and enthusiastic surgeons, the tendency is now to subject all cases to operation as soon as diagnosed. The result is to expose patients, in the worst possible condition for operative work, to extremely

difficult and dangerous operations which are not necessary at that time, whatever they may be later; and we stand to lose as many patients by such ill-considered action, as we did when operation was always postponed. A calm judicial frame of mind, capable of discrimination between cases which can, and those which cannot, be allowed to wait with safety, is much to be desired.

Even in those cases with a history, constant and careful watch is necessary, until the quiescent stage is reached. The relation between the rate of pulse, respirations, and temperature must be a matter of close attention; but the advantages so gained are so great that all the trouble is amply repaid by the result, if success is obtained.

In this relation, the question of geography, as Mr. Moynihan points out, may be a determining factor. If the patient can remain under the eye of a competent observer, delay is to be advised, all other things being equal; if he cannot, that fact alone may justify the surgeon in making an opening for drainage at once, although at that time it might not be wise to go further.

I will, in conclusion, mention two cases, which illustrate the points raised. The first is a primary case, or one without a history of previous attacks, which was left too long, and which ended in general peritonitis and death. This is one of the type which has provoked, and very properly provoked, men to promulgate this doctrine of immediate action, but which yet does not, I submit, justify its extension to all cases.

Case 1.—J. M., male, æt. 40, admitted September 27, 1902. Previous history of several attacks of flatulence, dyspepsia, and constipation, but no similar attack to that from which he then sought treatment.

On September 23rd he was seized with sudden pain in the abdomen, not localised to any particular region; two normal stools were passed, but produced no abatement of the pain, and he then sent for a doctor, who injected morphia. During the night, the pain returned so severely that morphia was again injected. From this time until the operation, four days later, no stool passed. On the third day, the pain was marked in the right lower quadrant, and tenderness could be elicited over McBurney's point; the abdomen was distended, clear on percussion, and there was vomiting; the matters vomited did not contain bile or fæcal material; but, after admission, the vomitus was brown, though still without fæcal odour.

On the fourth day, the abdomen was opened on the right side by an oblique incision, one inch internal to the anterior superior iliac spine. On

opening the peritoneum, the omentum was found adherent to the parietal peritoneum; this was separated and pushed upwards; the cæcum was found collapsed. In a pocket above the cæcum a small amount of pus, which was offensive, was found; then more pus welled up from the pelvis. This was sponged away, but more appeared after a large amount had been sponged away, and the cavity appeared to be dry, a large drainage tube, with a gauze wick, was passed down to its lowest point, which appeared to be by the side of the base of the bladder. The cavity in which the tube lay had for its outer and lower wall the iliac fossa lined by peritoneum; above lay the cæcum, and, internally, an apparently healthy loop of intestine not covered by lymph. As this loop was distended, and the whole abdomen was somewhat tense, it was drawn out and fixed in the wound with the intention of opening it in 24 hours, if no action of the bowels had been obtained before. This loop lay between a plug of gauze in the upper cavity and the tube covered by gauze below. Patient was very collapsed after the operation, and died without rallying from the shock.

At the autopsy, pus was found in large quantity free all over the abdominal cavity, but most marked in the renal fossæ and in the pelvis.

In this case, it is obvious that most valuable time was lost, and that, for the operation to have been successful, it could not have been done too soon. It is quite possible that the practitioner in attendance was misled by the effect of the morphia first injected, for during the first two days, he informs me, the symptoms all appeared to improve greatly; but the point which I wish to emphasise is, that this was a case without history of any previous attack of a similar nature; the virulence of the invading organisms, as well as the power of the resistive forces in this man, were unknown quantities. Anything was possible; the bodily powers might have been capable of an efficient resistance or, as unfortunately was the fact, the invaders might have been irresistible.

Contrast this case with the following:—

Case 2.—Mrs. B., æt. 33, sent by Dr. Riddall.

Prior to the present attack, the patient states that she has had for the past five years repeated attacks of pain in the right lower quadrant of the abdomen, accompanied by vomiting and diarrhœa.

The present attack began on September 18, 1907, with diarrhœa and great pain in the region of the appendix, which increased up to September 22. At that time she consulted Dr. Riddall, and stated to him that she was suffering from diarrhœa, which she attributed to the eating of plums and sequent taking of seidlitz powders to counteract their effects. She was ordered a mixture containing carbonate of bismuth and nepenthe. On the 23rd and 25th, she declared herself much better. On this day, the 25th, she went into Yorkshire, and remained there until October 2. During

this time, she had great pain in the appendical region, with vomiting and rigors, and was confined to bed.

On October 3, she saw Dr. Riddall, having returned the night before, and was promptly sent to bed. On October 4, he found much tenderness and some rigidity over McBurney's area. A long sausage-shaped swelling was present in this region; there was sickness and repeated rigors. T. 103.

On October 5, I saw her in consultation with Dr. Riddall. The patient lay in bed, with her right leg somewhat flexed; she complained of pain and tenderness in the right lower quadrant, the tenderest spot being rather higher and further outwards than McBurney's point. There was marked rigidity of the muscles of the abdominal wall in this region, though not elsewhere, and there was dulness spreading from Poupart's ligament upwards for from $1\frac{1}{2}$ to 2 inches, with a convex upper border. T. 103, P. 120. Some feeling of shivering from time to time; face placid; tongue moist; skin soft and moist.

On October 6, T. 103 in the morning, 104 in the evening.

October 7, T. normal. Removed to nursing home.

From the time of her admission, until October 19 (12 days), the temperature varied from 97 to 99·8, the pulse from 68 to 84. She vomited three times during the night after admission, twice on the 9th, but not after; pain was felt in diminishing amount until the 10th; the mass in the right inguinal region was well defined up to the date of the operation.

On October 19th, the appendix was removed. It was found buried behind the ascending colon, and surrounded by firm adhesions, which necessitated the division of it close to the cæcum and dissection downwards towards the tip, after closure of that opening. This dissection lasted for some time, and would certainly not have been borne, had the operation been performed at the commencement of the attack, or whilst the pulse and temperature were high. The appendix was kinked, dilated, and thinned at its extremity, and contained an enterolith. Some dried pus was found amongst the adhesions. Recovery was uneventful, the T. only reaching 99·6 once, and the pulse ranging from 72 to 80.

These two cases are simply given as examples. They could very easily be multiplied to a large extent, and show, I submit, that the division suggested is a most important one, and that we may contemplate with serenity, in cases with a previous history, temperatures, pain, and vomiting, which, in primary cases, should at once demand operation. By this distinction also we avoid interference, at an unfavourable time, with cases in which operative work is likely to be tedious, and therefore dangerous, until a period in which the same can be performed with safety.

VALVULAR DISEASE OF THE HEART.

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VIII.—PULMONARY STENOSIS.

Pulmonary stenosis comprehends all conditions of obstruction, at or about the pulmonary orifice, that hinder the passage of blood from the right ventricle into the pulmonary artery. Such obstruction may be congenital, or may have been acquired after birth. It is, in any case, a comparatively rare lesion, but the congenital type is far more common than the acquired. Indeed, if we exclude the minor degrees of patency of the foramen ovale, which are so frequent that they cannot justly be termed abnormal, there is no congenital cardiac defect so commonly met with as pulmonary stenosis. Of the exciting causes of such congenital heart disease but little is known. The influences, that induce it, seem to be transmitted from the maternal circulation to the fœtus. Accepting this view, we must presume that the same causes as are operative in producing heart disease in separate life, are operative in the period of fœtal existence. One cannot set aside the frequency of a history of acute rheumatism in one or both parents in cases of congenital heart disease. Syphilis too is suspect, but it is difficult to confidently assign to it a close causal connection. Experimental pathology has proved that bacterial toxines are capable of producing errors of development and disease in the embryo. If such arrive while development is incomplete, it would be reasonable to expect defects of development, while, with their invasion after development is perfected, we should expect to find disease similar to that acquired in the separate life of the subject.

Acquired pulmonary stenosis is a lesion of great rarity. Such records, as we have, show that it is referable, in some instances, to acute rheumatism, and to other acute infective diseases. In other cases, it has arisen directly out of septic states, such as puerperal fever. Looking at museum specimens

of acquired stenosis, and particularly at those, in which developmental defects exist along with it, one cannot resist the suggestion that, in at least a proportion of such cases, the obviously acquired disease has settled on an orifice, of which the resisting power was already lowered by pre-existent congenital disease.

Congenital pulmonary stenosis of high degree is almost

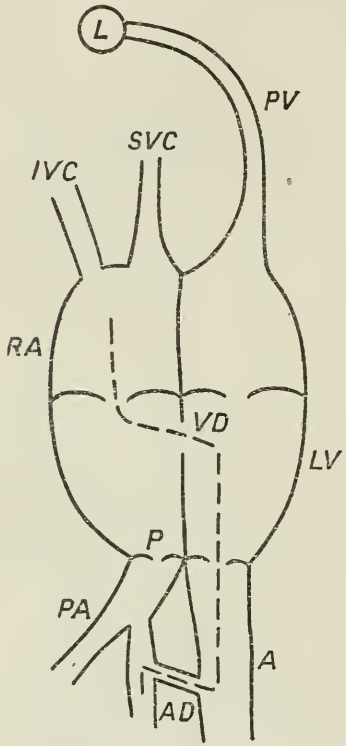

Fig. 1.

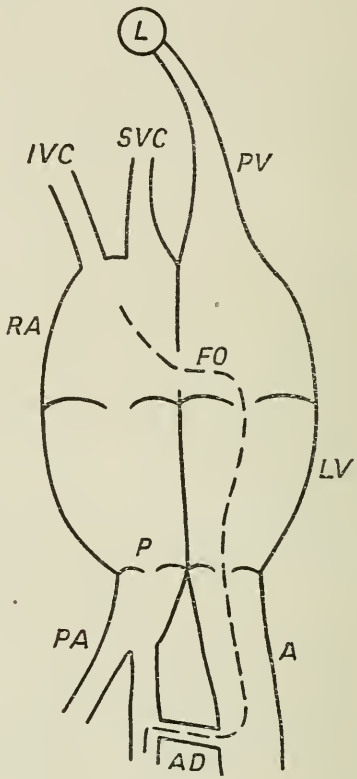

Fig. 2.

The dotted line in each figure represents the altered course of the blood stream.

A = *Aorta.*
AD = *Ductus arteriosus.*
PA = *Pulmonary artery.*
P = *Pulmonary orifice.*
VD = *Defect of ventricular septum.*
FO = *Patent foramen ovale.*
RA = *Right auricle.*
LV = *Left ventricle.*
IVC, SVC = *Inferior and superior vena cava.*
PV = *Pulmonary veins.*
L = *Lungs.*

always accompanied by other malformations. The most common of these is a defect of the ventricular septum in the undefended space; with this, in a considerable propor-

tion of cases, is found a permeable ductus arteriosus Botallii, of varying calibre. A less common association of pulmonary stenosis is patency of the foramen ovale of high degree; with this, there is less apt to be a permeable ductus than with a defective septum. Looking at the course of the fœtal circulation, it is difficult to avoid the conclusion that these associated malformations are direct consequences of the blood stream encountering an impediment to its flow at the pulmonary orifice. Yet, we are at once met by the difficulty that the septum of the ventricles should be completed before the pulmonary valves are developed. It would seem that the blood stream, finding its direct escape from the right ventricle into the pulmonary artery hindered, solves the question by adopting an additional circuitous route. In one case (Fig. 1), the route adopted may be by way of a defect in the septum of the ventricles into the left ventricle, and thence by the aorta to the ductus arteriosus, which returns the blood to the pulmonary circulation, *beyond the obstruction.* In another case (Fig. 2), an alternative course is taken by way of a patent foramen ovale and ductus arteriosus; and in yet another, these alternative routes will be found combined.

It is, of course, possible to reverse the argument, and contend that the defects in the septa, and the patency of the ductus arteriosus, lead to increased pressure on the right side of the heart, and so render its valves more prone to disease. This would help to explain those cases of pulmonary stenosis, apparently congenital, in which the valves are found rigid and thickened, without any constriction of the orifice.

Pulmonary stenosis may exist at three different levels:—

(1) At the situation of the orifice and valves;

(2) In the infundibulum of the ventricle;

(3) In the artery or its main sub-divisions.

The first of these is, of course, the usual situation, each of the others being extremely rare. In some cases of congenital stenosis, the narrowing of the pulmonary orifice may extend for some distance into the trunk of the artery, but this condition is quite distinct from the narrowing found at times in the artery without any affection of the orifice.

In this first form the orifice alone, or the valves alone,

or both together, may constitute the obstruction. When the orifice alone is affected, it appears as a firm, fibrous ring, causing, as a rule, not a high degree of stenosis. In other cases, the orifice is normal, but the valves are thickened, the thickening varying from mere opaque patches up to complete and uniform fibrosis, and even calcification of their substance. The highest degrees of obstruction are naturally those in which both valves and orifice are simultaneously affected. There may then be even complete atresia. More often, however, the valves are welded together, so as to show no trace of their tripartite character, and form a diaphragm with a central aperture, circular or irregularly linear in form. This diaphragm often projects, as a dome, into the lumen of the artery, being driven forward by the pressure of the blood stream in the ventricle.

In the congenital type of pulmonary stenosis the pulmonary artery may be narrowed, or at times even obliterated, as far as the point of entrance of the ductus arteriosus. In one heart that I have examined, the pulmonary artery and the orifice were obliterated, and the tricuspid orifice was very small, while the futility of a right ventricle, in such circumstances, was evidenced by the almost complete obliteration of its cavity, the tricuspid orifice facing directly through a patent ventricular septum into the left ventricle. In another heart, the pulmonary orifice and the artery beyond it were reduced to the calibre of a slate pencil, and the wall of the artery was so thin as to be transparent. In this case there was a large breach in the septum of the ventricles, and a patent ductus arteriosus, but the foramen ovale was closed.

Occasionally the pulmonary artery is widely dilated, the dilatation being greatest adjacent to the orifice. It is difficult to see, in the absence of a patent ductus arteriosus, to what this dilatation can be due. Perhaps it is that the elastic tissue of the artery loses its resilience, and yields passively, when its elasticity is not constantly and fully called into play.

In the acquired form of pulmonary stenosis, we find two main types. The one is indistinguishable from the lower degrees of congenital disease, and is actually accompanied, in many instances, by the same cardiac malformations. With this there may be evidence of vegetations, recent or old, on

the ventricular surface of the valves. It has been urged that, in cases such as this, the defects in the septa are due to reopening of apertures that have been already closed. It is inconceivable that this can be the explanation of the patency of the ductus arteriosus, whatever may be true of the septa, and it would seem more reasonable to assume that the phenomena of acquired endocarditis are implanted on valves, of which the resistance has been already lowered by congenital disease, which, in turn, is the cause of the cardiac malformations.

The other type of acquired disease leaves no room for doubt as to its nature. Typically, the valves are plastered with large warty vegetations ; these vegetations are not confined to the lines of contact of the sigmoid valves, but are seen also filling the pockets of the valves and spreading, in either direction, to the wall of the pulmonary artery and of the right ventricle. The lesion is not accompanied by other cardiac malformations. In dealing with this type of stenosis, mention must be made of the small gelatinous beads, which are occasionally seen along the convex borders of the pulmonary valves in cases of acute endocarditis of the left heart, similar to, though much less frequent than, those found on the tricuspid valve. Under the favourable low-pressure conditions of the right heart, these tend to spontaneous resolution.

Of rarer causes of obstruction of the orifice, one may mention tumours and sessile thrombi. I have recorded and figured one remarkable instance in the *Transactions of the Pathological Society*, 1898, pp. 37–41.

As has been already indicated, the obstruction may also lie on either side of the pulmonary orifice. In the one case, the obstruction is below the valves in the infundibulum of the ventricle, and the condition is closely analogous to the so-called sub-aortic stenosis. The latter may perhaps be an extension of a cicatricial process from the mitral orifice in advanced mitral stenosis, but, in the case of the right ventricle, we have almost certainly to deal with the consequences of an acute endo-myocarditis of the infundibulum, occurring in early life. Cicatricial transformation of the inflammatory tissue in the heart-muscle leads to the formation of a constriction,

just below the level of the valves. This is generally no more than a narrow ring of fibrous tissue, but cases are recorded in which the greater part of the infundibulum has been converted into a circular passage with smooth, unyielding walls. This sub-valvular stenosis may exist without any affection of the valves or orifice.

Again, the obstruction may lie ahead of the valves in the artery, or its main branches. This condition not infrequently exists along with stenosis of the orifice, but, as an independent entity, presumably due to precedent endarteritis, it has not come within my observation.

The changes in the heart itself, consecutive to pulmonary stenosis, take place in conformity with the laws that govern all forms of valvular disease. The increased work, thrown on the right ventricle during its working period, leads to hypertrophy with some dilatation, so that it comes to occupy the whole anterior aspect of the heart, intruding itself in front of the left ventricle. Its walls are thickened, sometimes even thicker than those of the left ventricle; the musculi papillares are large, and the columnæ carneæ prominent. The interventricular septum may even bulge into the left ventricle, reversing the normal condition of adult life. Exceptionally, in cases, in which the pulmonary stenosis is so great as to afford virtually complete arrest to the direct pulmonary circulation, the right ventricle may, as we have seen, undergo almost complete atrophy, persisting as a mere membranous vestige. In cases, that live to adult life, and, escaping pulmonary tuberculosis, die of heart failure, there may be considerable dilatation of the right ventricle, sufficient even to induce incompetence of the tricuspid valves. The same sequence of changes occurs in the right auricle, its walls are at first thickened, its musculi pecteriati large and strong, and subsequently dilatation supervenes.

Pulmonary stenosis is anomalous, since it is more apt to lead to a fatal issue by reason of the troubles that arise ahead of the lesion than by those behind it. A necessary consequence is pulmonary anæmia of varying degree. This renders the lung a favourable soil for pulmonary tuberculosis, just as mitral stenosis, by reason of the resulting hyperæmia, tends to arrest, or to hinder the development of tuberculosis in the

lungs. Tuberculosis is more common in the congenital than in the acquired cases, in which the actual obstruction is, as a rule, much less. In these, with their abundant loose vegetations, one is apt to find emboli carried into the lungs, setting up bronchitis, or pneumonia; and the end may come in this way, or, by progressive heart failure, as often as by pulmonary tuberculosis.

Pulmonary stenosis cannot be said to exhibit any characteristic train of symptoms. Indeed, so far as symptoms referable to the heart are concerned, it is often latent. This depends on the ability or inability of the heart to compensate the lesion, and to maintain equilibrium in the circulation. It is only, in the graver states of disturbed equilibrium, that the patient carries in his aspect the unmistakable evidence of disease. In the congenital type, physical development is usually poor; the child is delicate and listless, and the appearance may suggest tuberculosis. He is subject to shortness of breath, and a sense of oppression in the chest, or to dry irritable cough on exertion, so that he has never been able to play games like other children. Yet one is constantly struck with the indifference of children to the gravest heart disease. It is not that the signals are not set to danger, but they are children, and do not heed them. Cyanosis may be present constantly, or on exertion; such cyanosis may be of high degree, without any defects of the septa, permitting admixture of arterial and venous blood, and indicate lack of propelling power in the circulation, with consequent malaëration. Possibly, the more yielding character of the capillary venules in infancy may be a contributory cause to its greater prominence in congenital disease. There are apt to be complaints of chilliness, and the hands and feet are habitually cold. The fingers and toes may exhibit marked clubbing.

Some cases of acquired pulmonary stenosis are indistinguishable from congenital cases in their symptoms. This would seem to afford some confirmation of the view that the acquired disease has then been grafted on to a congenital defect. At other times, the clinical picture is the habitual presentment of heart disease: pallor, dyspnœa on exertion, and general disability. And yet others may show all the symptoms of circulatory sepsis, the lesion being of

so-called malignant type. Congenital stenosis is more prone to pulmonary tuberculosis than the acquired form. In the early stages, before the evidence of tuberculosis is confirmed by the detection of tubercle bacilli, the presence of fever, and of equivocal signs in the lung, makes it very difficult to decide between malignant endocarditis and simple endocarditis complicated by tuberculosis of the lungs. In those cases that escape tuberculosis, and terminate in cardiac failure, there will be the familiar features of right heart failure, sometimes with signs of stasis in the pulmonary circulation from defective *vis a tergo*.

The visible signs of pulmonary stenosis are, as a rule, insignificant ; there may be visible pulsation over the front of the heart and in the epigastrium, and, in extreme cases of congenital origin, even præcordial bulging. Enlargement of the right heart serves to displace the apparent apex outward. But it is on the murmur and thrill that diagnosis rests. The thrill is less constant than the murmur ; when present, it is systolic in time and superficial, and usually intense. It is most marked at or about the second left interspace, close to the sternum, and may be felt anywhere between this point and the left clavicle. The murmur has the same distinctive features as the thrill, the pulmonary orifice lying so comparatively close to the chest-wall. A well-marked murmur is not only systolic, but fills the whole systolic phase. It is propagated upwards and outwards towards the left clavicle ; exceptionally, it is audible over a wide area around its site of production. It is louder in the recumbent posture. The pulmonary second sound is variable, but there is this distinction from aortic stenosis, that the second sound is usually diminished, while, in aortic stenosis, from collateral causes, it is usually accentuated. There may also be reduplication. The radial pulse presents no characteristic features.

Pulmonary stenosis of sensible degree is always a grave lesion. Of the congenital cases few grow to adult life. It is true that, now and again, evidence of stenosis is found in an adult in full health, but in such the degree of constriction must be very slight. With higher grades, the outlook is always bad and most die in childhood. Should the ever present danger of pulmonary tuberculosis be avoided, cardiac failure must

inevitably ensue. In such a case, the degree of cyanosis and dyspnœa, the severity and duration of bronchitic attacks, and the liability to syncopal attacks are points to be considered in estimating the outlook.

In the acquired cases the condition is even more hopeless than in the congenital, for, in such, we have to deal either with a fresh accretion of disease on a pre-existing congenital lesion, or with a process of malignant infectivity. A few years, at the most, is the life-history of such a case.

The diagnosis of pulmonary stenosis may be beset by great difficulty. It depends primarily, as we have seen, on the presence of a systolic murmur in the second left interspace, conducted upwards and outwards towards the left clavicle, such murmur being typically harsh and superficial, and accompanied by a thrill. Further, the second sound is diminished, sometimes reduplicated, and with this is evidence of hypertrophy, or dilatation of the right ventricle.

In congenital cases, even if the physical signs in the heart have escaped detection, defective development, bodily and mental, with shortness of breath and cough on exertion, will suggest cardiac disturbance. Marked cyanosis, with clubbed fingers, is probably congenital, but not certainly ; for congenital cases may occur without cyanosis, and acquired cases may undoubtedly exhibit it. The presence of associated malformations, and particularly patent ductus arteriosus, is in favour of congenital disease, but not distinctive, for there is at least evidence to suggest that such malformations may determine the access of disease to the pulmonary valves. The difficulty of distinguishing, during life, the acquired from the congenital form will be appreciated, when a case presents itself on the post-mortem table, which it is impossible to assign definitely to either. As congenital cases seldom reach adult life, age will be in favour of acquired disease, particularly if there is a history of acute rheumatism, or other infection, from which to date the lesion. Septic endocarditis stamps the disease as acquired, but it does not exclude precedent congenital disease.

A murmur may be readily referred to the pulmonary orifice, but it may be very difficult to determine, whether the murmur is organic or functional. Functional murmurs in this situation are of daily occurrence. They are by no means confined to

the anæmic. As a rule, they are soft and blowing; they accompany, but do not replace the first sound. They occupy usually only the middle portion of systole. They fade away rapidly, and can hardly be said to be propagated at all, at any rate, in the erect posture, though, in recumbency, they are louder, and carry a little further. They are not accompanied by obvious changes in the right heart or in the pulmonary second sound.

Among functional murmurs, I am familiar with one that is apt to be misinterpreted. Perhaps it is most often met in young lads of 17–20 years, who have grown quickly, and whose upper chest is flat and ill-expanded, in proposals for life assurance, when the action of the heart is excited. It is the loudness of the murmur that attracts attention, but, beyond this loudness, it has all the characters of a functional murmur, and none of those of an organic, nor its associations. Such murmurs are louder during inspiration, and are literally cardio-pulmonary, the pulmonary artery being compressed by the flattened chest-wall through the medium of the lung. Another interesting murmur of functional character is seen in pleural effusion of large size on either side of the chest. I have several times watched its waning and ultimate disappearance, when the fluid is drawn off. It is clearly referable to kinking of the pulmonary artery. There is seldom any difficulty in distinguishing a systolic murmur, produced at the pulmonary orifice, from a similar murmur, produced at the aortic orifice. It is true that an aortic systolic murmur of organic origin may be best heard in the pulmonary area, and that a pulmonary systolic murmur may be transmitted faintly into the aortic area. But an aortic systolic murmur is conducted into the vessels of the neck, a pulmonary systolic, never. In the one case, the consecutive changes are in the right heart, in the others, in the left, and the radial pulse may give further help. Functional aortic murmurs are soft and strictly localised, and are not transmitted into the pulmonary area. Now and again, a mitral systolic murmur invades the pulmonary area; but, as a rule, by determining the site of maximum intensity and the main line of propagation, any difficulty of discrimination disappears.

Differentiation of pulmonary stenosis from defects in the

septa is a matter of much greater difficulty, and quite often impossible. We are not concerned with those cases, in which the defect gives rise to no murmur, but only to cyanosis ; such is most common with communication between the two auricles. Commonly a defective septum, either of auricle or ventricle, gives rise to a loud systolic murmur, audible all over the heart. If such is loudest over the mid-heart, and is propagated with equal intensity in all directions, it may reasonably be assigned to a defective septum. But when, as is so frequent, pulmonary constriction and the defect in the septum concur, there will be the greatest difficulty in deciding whether we are dealing with one defect or two. Theoretical differences of the site of maximum intensity and of the line of conduction of the murmur do not serve to solve the puzzle.

Patent ductus arteriosus may generally be recognised with a reasonable degree of certainty. The murmur is systolic, but begins late in systole, and is prolonged into the diastolic phase. Like pulmonary stenosis, it is best heard in the pulmonary area, and is usually accompanied by a thrill. If the pulmonary second sound is obliterated, there is some resemblance to a pulmonary lesion with a double murmur.

In the treatment of pulmonary stenosis, it is necessary before all things to bear in mind the special susceptibility to pulmonary tuberculosis. The safeguard against this is the maintenance of a high standard of well-being, and avoidance of all that is likely to excite bronchial catarrh. So far as practicable, a dry climate of moderate and equable warmth is the best, but there is no need to expatriate a patient in search of it. For the rest, in the matter of exercise or exertion, one must determine each individual's limit of tolerance, and keep him well within that margin. In the slighter degrees of pulmonary stenosis the danger is of too much care. It is more often necessary to relax the fetters than to tighten them, and though, at the outset, it may need some moral courage to cast aside burdensome restrictions that have acquired the sanctity of years, there is nearly always in store a rich reward in the betterment and gratitude of the patient.

In cases of greater severity the further treatment is necessarily symptomatic, on the lines generally applicable to cardiac failure.

SIMPLE NASAL OBSTRUCTION.[1]

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THE subject of nasal obstruction is such a large one, and involves side issues of so varied a nature, should one attempt to discuss it in all its connections, that I make no apology for limiting my communication to what I have termed simple nasal obstruction, *i.e.*, obstruction to the free passage of air. I am aware of the difficulty that I shall have in keeping to the track by thus curtailing my subject, but I shall endeavour not to deviate from it.

We have the septum, dividing the organ into two lateral halves, acting as the internal boundary of both nasal fossæ. It is composed of cartilage anteriorly, and of bone posteriorly, the pericondrium and periosteum being intimately connected with the mucous membrane. The internal wall of either fossa is much more irregular. Running from before, backwards, are the three turbinate bones, covered by mucous membrane, and forming the inferior, middle, and superior turbinated bodies, or turbinals. The inferior turbinate, being part of the superior maxilla, is composed of firm, compact bone, whereas the other two, ethmoidal turbinates as they are sometimes called, partake of the cellular nature of the bone of which they are a part, viz., the ethmoid. Beneath these turbinals we have respectively the inferior, middle, and superior meatuses. In reference to the subject of this paper, the naso-pharynx must be considered a part of the nose.

Normally, the space for the transmission of air is restricted to the narrow channel between the internal and external boundaries, and to the meatal passages. In this respect, the value of these increases from above, downwards, *i.e.*, the inferior meatus is the most important.

Nasal respiration has, for its aim, the heating, moistening, and purifying of the inspired air. For this purpose, the mucous

[1] Read before the Scottish Division Border Counties Branch British Medical Association.

membrane is arranged in such a manner as to expose as large a surface as possible to the current of air, and it is probable, too, that the lining membrane of the accessory nasal sinuses lends its aid. In parts the submucosa is plentifully supplied with blood vessels in the form of wide venous spaces, these being found in greatest amount in the region of the inferior turbinal. The mucous membrane is also well supplied with glands, which are more abundant in some parts than in others. On entering the anterior orifice the air current is split up by the inferior turbinal, part, no doubt a large part, passing by the inferior meatus, while the rest is deflected upwards to the middle meatus and by way of this channel to the accessory cavities which open into it, to wit, the frontal, maxillary, and anterior ethmoidal. A small quantity, no doubt, reaches the superior meatus, and the sphenoidal and posterior ethmoidal spaces. And so it is brought about that much of the air, before it is drawn through the posterior nares, has had time and opportunity, during its residence inside the nose, to undergo those changes for which, in part at any rate, the organ is provided.

Anything which encroaches on the free space of the nasal cavities, or which interferes with the patency of the anterior and posterior nares, will cause nasal obstruction in greater or less degree, and, in addition to the interference with the passage of air, we shall get, when the obstruction is situated in certain parts of the cavity, effects due to blocking of the openings of the accessory spaces, or to pressure on, or irritation of, nerves either directly, or as a result of congestive, inflammatory, or purulent changes consequent on the obstruction. It is with the obstruction, as it affects the air current, that we are concerned. As one would expect, this is found most marked when the obstruction is so situated that it completely closes the openings of both fossæ anteriorly or posteriorly at the same time. The commonest example of this is furnished by a severe case of adenoids, and with such we are all familiar. Among rarer causes acting in this way are bony and fibrous occlusion of the posterior nares, new growths, malignant and simple, in the naso-pharynx, adhesion of the soft palate to the pharyngeal wall, congenital in nature, or the result of ulceration caused by disease or accident. Occasionally, the naso-pharynx is badly developed, and a certain amount of nasal obstruction

is complained of. This is worth remembering in relation to adenoids. The anterior nares are rarely completely obstructed on both sides. It is not uncommon to get narrowing from cicatricial contraction, due to former ulceration, and moreover the inspiratory act is sometimes interfered with by want of tone and falling in of the alæ nasi. New growths, gummata, lupus in this region may lead to obstruction.

The best example of severe obstruction, caused by intra-nasal conditions, is found in that tiresome affection, from which, in this part of the world, few of us escape—a head cold. Here the airway is encroached on, or altogether obliterated, by the congestion and swelling of the mucosa, one side suffering more severely than the other if it is already narrowed by some abnormality. As with acute catarrh so with the chronic variety we may get the changes in the mucous membrane distributed generally; but it will better serve our purpose to consider intra-nasal obstruction in more detail and unilaterally. Hypertrophy of the inferior turbinal claims our first attention. This structure may be enlarged in its entirety, the ends only may be affected, or the changes may be limited to the bone or to the soft part. The commonest condition is hypertrophy of one or other extremity. Much less common is hypertrophy of the middle turbinal, usually of the anterior end. Though this is of prime importance in relation to other branches of nasal surgery, and to other nasal phenomena, it is evident that, unless the enlargement is great, it is not likely to interfere much with the free passage of air. Still, a decided hypertrophy of the anterior end of the middle turbinal, both of the mucosa and of the bone itself, is not rare: it is sometimes found distended so as to form a bone cyst, and this may be of such a size as to give rise to complete obstruction. Looking now at the inner boundary of a nasal fossa, it is rather with the hard part than with its covering that we have to deal. The septum frequently has outgrowths called spurs growing from its surface. The commonest site is at the junction of the maxillary crest with the cartilaginous portion. These spurs are usually composed of bone, and, as they are situated, as a rule, opposite to the inferior turbinal, it is easy to under-

stand that they may give rise to a good deal of respiratory difficulty. Another common septal abnormality is displacement, or septal deflection, as it is technically called. The part affected, as a rule, is the cartilaginous portion. Much less frequently is the vomer involved, at any rate to an appreciable extent. Thickening of the maxillary crest is however a common addition. Sometimes the deflected portion is bent as well, so as to more or less block both nostrils, and again it is not unusual to have a deflection and a spur combined. I shall only mention hæmatoma, abscess, œdema, new growths, as other conditions affecting the septum, which may give rise to difficulty of nasal breathing. Probably next in frequency in causing obstruction are polypi. There was a time when polypus summed up the diagnosis in all nasal cases. But all that is changed, though the popular mind is where it was. These growths may be found in both nostrils and this is usually the case. They may attain enormous dimensions, speaking comparatively, and they may cause not only complete obstruction, filling both the nose and the naso-pharynx, but also changes in the contour of the nose.

In reference to the blocking of one nostril, mention must be made of the possibility of the presence of a foreign body. In children, especially, a one-sided obstruction with purulent discharge should make us strongly suspect this as the cause. Though adults are not so given to this playful habit, it is not a rare experience to have to remove from the nose of an adult a foreign body, which has lain there, it may be, for years. A piece of necrosed bone, usually from the ethmoid, may act in the same way. Other causes of obstruction, of which the mention alone must suffice, are growths springing from, or growing through, the boundaries of the fossa, bone cysts of the ethmoid, other than of the middle turbinate, adhesions between the inner and outer walls. Moreover, it should be said that the amount of discharge present, as the result of increased secretion or inability on the part of the patient to expel it, may act of itself to cause obstruction, or to accentuate that due to some other nasal condition. In atrophic rhinitis, the discharge, as a rule, forms into crusts, which give rise to obstruction, but this symptom is sometimes complained of where little discharge is found, and where the fossæ are unduly

patent. No doubt here the lack of the resistance to the inspiration of air, which is got in the normal state, by calling for less effort in the performance of the act, gives rise to the sensation of obstruction, such a sensation, for instance, as one experiences in trying to suck through a wide tube. And lastly, in rare instances, obstruction may be complained of without any nasal abnormality being present. Some of these are, no doubt, hysterical, but, in a few, there is probably faulty or erratic action of the soft palate.

Before leaving this part of the subject, I need hardly say that, though I have considered the causes of obstruction singly, we may have almost any and every conceivable combination, a septal deflection with polypi, or with turbinal hypertrophy, adenoids with turbinal hypertrophy, and so on.

The effects of simple nasal obstruction are local and remote, or, to put it differently, effects on neighbouring tissues and organs, and on the body generally. Locally, changes occur in the pharynx and larynx, in the ears, in the conjunctivæ, in the face, and in the mouth. In all these situations, we may see in one and the same case, of adenoids for example, the bad effects of the blocking of the nasal passages. These have been so often and so fully discussed in relation to this condition that I shall not go into them in detail. But in obstruction from other causes, and in the adult, much the same results, though differing in degree, are frequently observed, such as laryngitis, pharyngitis of various kinds, congestion and œdema of certain parts of the face. The changes in the ears deserve more than passing mention. The commonest aural condition, consequent on nasal obstruction in the adult, is one of thickening of the lining membrane of the Eustachian tube and tympanic cavity, with subsequent adhesions and immobility of the ossicles, a slow and progressive process. Other middle ear changes are, however, sometimes the result of nasal abnormalities, and, even if chronic otorrhœa is not a direct consequence, it is, at least frequently, aggravated by the re-infection, which the nasal condition promotes, and which hinders the cure by simple antiseptic and other treatment.

Among the more general results are physical and mental debility, a lack of energy and a disinclination for concentrated or protracted mental exertion. In children, the subjects of

adenoids, the interference with the development of both body and mind is sometimes very striking, a condition of practical imbecility being occasionally observed. Headache, in the shape of a sense of oppression and weariness, is not an uncommon complaint. Any mental effort may bring it on, or it may appear on waking in the morning, and pass off after an hour or two. In such cases in the adult, it may be found that the nasal obstruction is of an intermittent character, and only shows itself in the recumbent position, the nostril of the side lain on being the more affected. At the same time, it should be said that, in the production of the general effects, there are other factors to be considered than the interference pure and simple with the passage of air through the nose. This is a subject with which I have dealt elsewhere,[1] under the title of Nasal Headache, so that I shall not consider it further here.

There falls now to be considered the important question of treatment, and, as any one of the conditions causing obstruction might reasonably demand a paper at least as long as the present for the consideration of its appropriate treatment, it is evident that I cannot do more than discuss this part of the subject in a very general way.

Certain of these affections admit of only one treatment—removal; at any rate it would appear to be waste of time to debate this. Sometimes, in dealing with adenoids, which may be causing little obstruction to breathing, we may hesitate to advise their removal. If, however, there is an ear disease dependent on them, or if they are a source of danger from purulent processes connected with them, our position towards them will be modified. It is rather, however, in the treatment of certain intranasal affections that there is real difference of opinion. On the one hand we have, surgically speaking, the passive resisters, on the other, the very active operators. If we could only combine th two in the proportion, say, of one-third of the former with two-thirds of the latter, we should get, I think, a well-balanced nasal surgeon. It should be our endeavour to leave, compatible with the establishment of sufficient nasal breathing, as much of the functionating part of the nose as possible. This is, of course, merely stating in nasal terms what is a prime rule in all surgery. This rule,

[1] *Glasgow Medical Journal*, October, 1906.

however, should not be made a bogey in intranasal operative procedure. To take a concrete instance, if it is possible in a case of inferior turbinal hypertrophy to obtain a sufficient airway by a slight reduction of the redundant tissue by the use of lotions, sprays, ointments, or even by the cautery, well and good, but, if the removal of one end of the structure, of both ends, or even of the whole turbinal is required, we should not hesitate to carry this out. It is quite true that the improvement in the methods of operative treatment of abnormal conditions of nasal structures, and perhaps, this applies more to the septum than to other parts, is a temptation to excessive surgery, still it is surely a confession of weakness to make this an excuse for going to the other extreme.

In some cases it may happen that the re-establishment of nasal respiration can be best obtained by sacrificing a normal structure rather than by dealing with an abnormality which may be present. This consideration arises especially in connection with septal deformities, where removal of the anterior end of the inferior turbinal may serve the purpose as well as by attacking the septum. However, since the introduction of the sub-mucous treatment of septal deflection and septal outgrowths, with the consequent improvement in the healing process, this surgical substitution less frequently arises. In connection with aural affections, there is no doubt that, by the removal of nasal conditions, which may not be giving rise to a high degree of obstruction, and which, on this account, might be left alone, we frequently get an increase in the hearing distance. But this is a large, and, to a certain extent, a controversial subject, and one into which many considerations enter, so that it would be unwise to discuss it in a few words.

The result of the re-establishment of sufficient nasal respiration is, in the great majority of cases, of a most satisfactory character in regard both to the dependent local affections, and to the general health. We are all familiar with the benefit which follows the removal of adenoids in children, and in adults the result is, in many cases, not less pleasing. In some cases, the removal of the nasal affection must be looked upon, not as the end, but as a necessary preliminary to the treatment of the secondary diseased conditions.

THE SO-CALLED ADENOMATA OF THE PALATE.

By T. P. LEGG, M.B., M.S., F.R.C.S.,

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[With Plates IV.—VII.]

In the *St. Bartholomew's Hospital Reports* for the year 1886, Mr. Stephen Paget published a paper on "Tumours of the Palate." A list of 31 cases of the so-called adenomata was given, and the similarity in structure of these tumours to those of the salivary glands was pointed out. In 1892, Nasse (*Langenbeck's Archiv*, XLIV., 233) showed that many of the mixed tumours of the palate and salivary glands were derived from endothelium. Mr. Butlin, in the last (1900) edition of his *Operative Surgery of Malignant Disease*, said "that most of the innocent tumours of the palate are endotheliomata, and that most, if not all, of the tumours which were at one time regarded as spheroidal-celled carcinomas are endotheliomas; and that a large number of tumours, which were formerly classed among the sarcomas (plexiform sarcomas and cylindromas), are really endotheliomas."

Since Mr. Paget's paper was published, I have been able to find a comparatively small number only of cases reported.[1] During the last five or six years, I have observed six cases of this form of palate tumour, and, as they illustrate exceedingly well their characteristic features, I propose to describe them in detail.

Case 1.—The patient was a woman, aged 62, under the care of Mr. Watson Cheyne. She was admitted to King's College Hospital on July 8, 1901, and had noticed the tumour for eight years. When first discovered it was about the size of a pea, but it had been gradually increasing in size. The tumour was situated in the mid-line of the hard palate. It was quite smooth, the mucous membrane covering it was

[1] Morton: "Adenoma Soft Palate," *Trans. Path. Soc.*, XLIV., p. 59. Robinson: *Path. Society Trans.*, XLI., p. 83. "Surgical Registrar's Report," *Bart's Hosp. Reports*, 1902, p. 173. Workman: *Glasgow Medical Journal*, LIX., p. 287. *Bul. Soc. med. d. hôp. de Lyon*, 1903, II., 110–114. *Bul. et mem. Soc. de Clin. de Paris*, 1903, two cases Berger: *Revue de Chirurgie*, No. 7, 1897

normal, except for a few dilated vessels. At its anterior part the tumour was soft and elastic; at the posterior part it was firmer. The lymphatic glands in the neck were not enlarged. Except that "her mouth felt full," the patient complained of no symptoms.

The tumour, with the mucous membrane and the adjacent portions of the soft and hard palate, was excised. She made an uninterrupted recovery, and was discharged eleven days after the operation. The pathologist reported that "part of the tumour simulated salivary gland tissue; part was carcinomatous, the cells in the badly-formed alveoli being typically cancerous."

This patient has had no recurrence up to the present time.

Case 2.—A woman, aged 22, was admitted under Mr. Watson Cheyne, on November 30, 1903. For an indefinite time she had noticed the tumour, but it had caused no inconvenience, and had not increased in size. On examination, a tumour as large as a cherry was found on the right side of the mid-line of the hard palate, close to its junction with the soft palate. The edges were smooth and shelving; it was not movable. The mucous membrane was healthy except for a dilated vein or two. There were no enlarged lymphatic glands in the neck. On December 4th the tumour was shelled out, the incision in the mucous membrane being closed by two stitches. She has remained quite well, and has had no recurrence.

Case 3.—A girl, aged 11 years, was admitted under Mr. Barrow in October 1904. The tumour had been noticed since the previous November, and had been steadily increasing in size without causing any symptoms. It was situated on the right side at the junction of the hard and soft palate, and was about the size of half a walnut. The greater portion was in the soft palate, the mucous membrane over it being slightly congested. It was quite smooth, and had well-defined edges. The tumour, which was removed by enucleation, was a yellowish-white solid, and microscopically it was "an endothelioma, like a parotid tumour, with mucoid tissue, and some glandular structure." There has been no recurrence.

Case 4.—A woman, aged 56, was admitted, under my care, into the Royal Free Hospital, on August 11, 1905. The tumour was accidentally discovered three years ago; it was

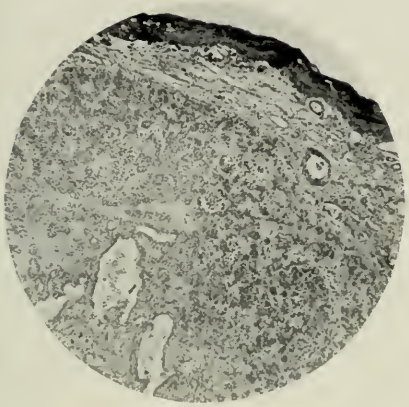

Fig. 1.—*Taken from Case 2: low power. The capsule and vessels are shown. There is a small amount of stroma and well-marked alveoli.*

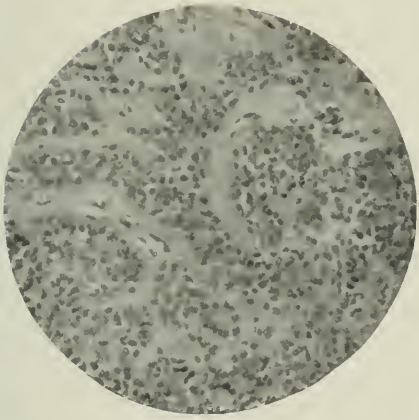

Fig. 2.—*Same section as Fig.* 1, *but more highly magnified. The shape of the alveoli, their relation to the vessels, and the character of the cells are shown.*

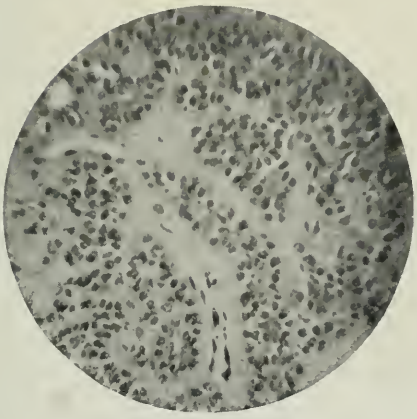

Fig. 3.—*Same section as Figs.* 1 *and* 2, *shows the character of the cells and the shape of the alveoli.*

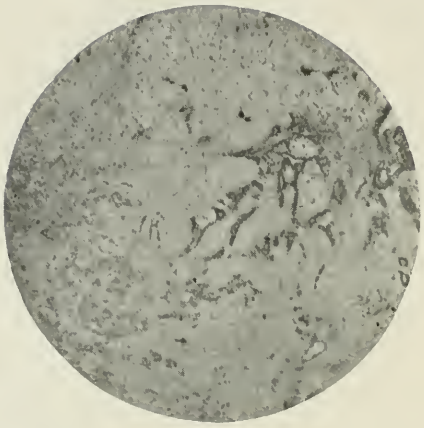

Fig. 4.—*Taken from Case* 3. *The section shows a large amount of myxomatous tissue and irregular branching alveoli. On the left-hand side the alveoli become more numerous and less branched.*

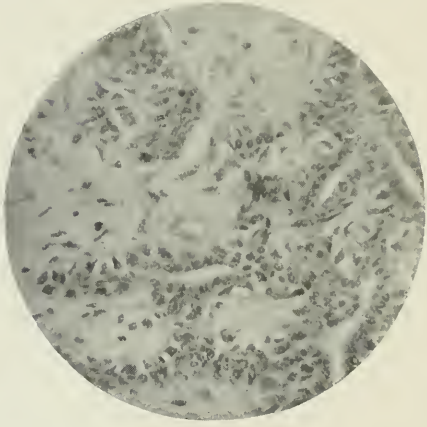

Fig. 5.—*A part of the preceding more highly magnified. The characters of the cells are well shown.*

Fig. 6.—*Another part of the same section from which Figs.* 4 *and* 5 *are taken. The amount of matrix is small. The arrangement of the cells around the vessels and their shape are shown.*

then the size of a pea, and had grown slowly till three months ago. Recently, it had been rapidly increasing in size. On the right side of the soft palate there was a smooth, elastic, well-defined, globular tumour as big as a walnut. The mucous membrane over it, except for some dilated veins, was normal. There were no enlarged glands in the neck. It was removed by enucleation. It was solid throughout, and had a yellowish-white colour. She left the hospital ten days after the operation, and there has been no recurrence. Sections of the tumour show that, in some places, there are large areas of loose myxomatous tissue; in other places, there is little matrix and large areas of cells, so numerous that an alveolar arrangement is scarcely discoverable. In other parts, the alveoli are irregular in shape, but there are alveoli similar to those in Fig. 2.

Case 5.—A woman, aged 51, was admitted under the care of Mr. James Berry. When she was 17 years of age, the left tonsil was removed; four years later, the right one was removed. The present tumour was discovered by her doctor, about a month before her admission to the hospital, on June 18, 1906. She then complained of a sore throat, a bad cold, and difficulty in swallowing. The tumour was a very large one, occupying the whole of the right side of the soft palate, pushing the uvula to the left, and extending outwards as far as the ascending ramus of the jaw. Downwards, it extended into the pharynx, but its lower border could be reached. The tumour was so large that the fauces were partially blocked. It was quite smooth, elastic, and not painful on palpation. The mucous membrane over it was slightly congested. There were no enlarged glands at the angle of the jaw. On June 25, the growth was partially enucleated, and partially scraped away with a sharp spoon. The hæmorrhage was easily controlled by pressure and adrenalin. She left the hospital on July 7, and up to the present time, there has been no recurrence. The growth was a soft solid, yellowish-white in colour. Microscopically, the matrix is composed of hyaline or myxomatous tissue. The cells had an elongated or circular nucleus, they were arranged in alveoli of various sizes and shapes, some being quite small: in other parts of the section, they formed strands or columns, with little hyaline material between the strands.

Case 6.—A man, aged 63, was admitted to the hospital under Mr. Cunning. The tumour was first accidentally noticed eight days before admission. It was situated at the junction of the hard and soft palate on the right side, and was as big as a walnut. The edges were well defined, its surface was quite smooth, and the mucous membrane over it was normal. There were no enlarged glands in the neck. The growth was removed, partly by enucleation and partly by scraping. It had a yellowish-white colour and was quite solid. Microscopically, it was reported to be an endothelioma.

These tumours occur at all ages, and appear to be equally common in men and women, though in the above series set forth, there are five women to one man. They are more frequently found in the soft palate, and when in the hard palate, they are generally at its posterior part. The small amount of inconvenience, to which they give rise, even though the tumour has reached a large size, is an interesting feature. In Case 5, it is probable that the symptoms, of which the patient complained, were due to a sore throat, and not to the tumour. It is scarcely possible for it to have reached such a size in a month, and yet, when she was under observation, that it should be symptomless, for she could swallow and talk without difficulty. In other patients, when the tumour has almost filled the mouth, the only symptoms complained of have been some alteration in the voice, and perhaps some difficulty in swallowing.

The presence of the tumour is not infrequently discovered accidentally, either by the doctor or the patient. In the cases described above, the duration of time, the tumour had been noticed, varied from one month to eight years. A "long history," often extending over many years, is the rule, and in those patients, who come under observation soon after the presence of the tumour is discovered, the size would suggest that it has been present for a long time. Even when the patient is young, it is frequently found that the tumour has been present many months or years.

Growth is usually slow, but it varies at different periods. It is not uncommon for the patient to seek advice, because the tumour has been rapidly increasing in size, after it has been known to be present for a long time.

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Plate VI.

Fig. 7.—*Another part of the same section from which Fig.* 4 *was taken. Note the difference in the arrangement and amount of the alveoli.*

Fig. 8.—*The section is taken from Case* 6. *The hyaline matrix is abundant, and the alveoli are lined by a single layer of flattened epithelial cells. In other places the section has appearances similar to those shown in Fig.* 6.

Plate VII.

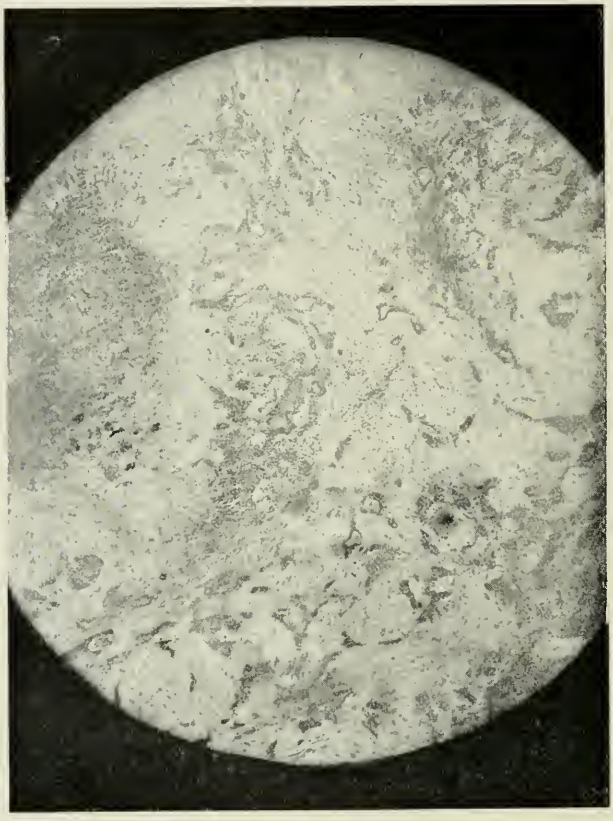

Fig. 9.—*Taken from Case 3: low power. The section shows the different kinds of alveoli in the same field, and the large amount of myxomatous matrix.*

All these tumours appear to be solid, and only rarely contain cysts. They are white, or yellowish-white, in colour; homogeneous, caseous, or granular. Sometimes they are soft and friable, and have to be removed by scraping. They have a definite capsule, and are not pedunculated. The mucous membrane covering them is normal, or slightly congested. If the tumour is large, the mucous membrane may be thin and atrophied.

Enucleation is the best and easiest method of treatment, an incision being made through the mucous membrane over the tumour, which can then be removed by a blunt instrument. The tumour sometimes comes out whole, or it may be necessary to scrape it away with a spoon. This is not of much importance, provided that the whole mass is removed. The hæmorrhage is usually slight, and can be controlled by pressure. If the growth is in the hard palate, the bone beneath it may be hollowed; in these cases enucleation can be carried out in the same way, and it is rarely necessary to remove any of the bone.

The question of the liability of these tumours to recur is closely connected with the method of removal. If recurrence took place frequently, it would be necessary to perform a much larger operation. The majority of cases, which have been published, illustrate the histological characters of these growths, and no mention is made as to whether a recurrence had taken place. Mr. Paget, in his paper, gives a list of 31 cases; in only one of these is it stated that there had been no recurrence; in this case the patient was well ten years later. In *St. Thomas's Hospital Reports*, Vols. 30, 31, and 33, there is an account of the case of a nurse, aged 42, who was first operated on, in January 1901, for a tumour of the soft palate, which had been present $2\frac{1}{2}$ years, and had grown rapidly for three mouths. It was as large as a pea, the mucous membrane over it being ulcerated. Excision of part of the palate was performed in July 1902; she was again operated on for a recurrence of three months' duration. A year later, there was no return of the growth, but, in December 1903, recurrence again took place, and grew slowly till April 1904, when it was excised. The tumour formed a small hard lump just to the left of the mid-line of the soft palate. The case is

headed "recurrent endothelioma." The microscopical report of the last recurrence is described as "chronic periadenitis."

All the cases described have been free from recurrence, and are quite well at intervals varying from twelve months to more than five years. It is interesting to notice that the pathologist reported that the tumour in the first patient was "typically cancerous in places," yet this patient has been well for the longest time. The sixth patient was operated on in August 1906; when seen twelve months later, there was no recurrence.

The similarity of these growths to the so-called "parotid tumours" has already been mentioned. It is a clinical fact that parotid tumours may exist for many years, grow slowly, and be apparently completely removed. Yet early recurrence is not very uncommon. So far as this small series of palate tumours is concerned, it would seem to show that recurrence is not likely to take place.

The absence of glandular enlargement is important, as enabling the diagnosis from true malignant disease to be made. The healthy condition of the mucous membrane is of value in helping to make the diagnosis between inflammatory affections on the one hand, and malignant disease on the other. True ulceration is not present. The mucous membrane has been found to be stretched so as to be perforated, the tumour being visible as a white growth through the holes so formed.[1]

The histological appearances of these tumours is shown in the accompanying photographs. I have been unable to discover the sections of the first case, which, in view of the after history of the patient, is to be regretted, as the section was said to be typically cancerous.

A well-defined capsule, containing blood vessels, is present (Fig. 1). The matrix, or ground substance, consists of either hyaline or myxomatous tissue (Figs. 4, 5, and 8). In some parts it is very abundant (Figs. 4, 5, and 9), and in another part of the same section there is very little matrix (Figs. 2 and 6). The cells of the matrix have an elongated or branching nucleus (Fig. 5).

All the sections show an alveolar arrangement of the

[1] Workman: *Glasgow Med. Journal*, LIX., p. 287.

cellular elements, the shape of the alveoli and the characters of the cells varying in the different sections and in different parts of the same section. The alveoli may be quite clearly shown—circular or elongated in shape (Figs. 1, 2, 3, and 6). In another part of the same section it may be almost impossible to distinguish any alveolar arrangement (*see* Fig. 7). There may be no lumen in the alveoli (*see* Figs. 2 and 3), or the lumen is slit-like, branched, or irregular (Figs. 4, 5, and 8). Where these latter types of lumen are found, it will be noticed that the alveoli are not so numerous or so closely packed (Fig. 4). The cells themselves are rounded, with a circular nucleus (Figs. 2 and 3), or they are columnar (Figs. 5 and 6), or they are flattened (Fig. 8).

In Figs. 2 and 3 the relation of the alveoli to vessels is shown. This is best seen in Fig. 6, and the arrangement of the cells in this figure, and in Fig. 5, is noteworthy. It will be noticed that the cells are arranged in the direction of the radius of the lumen of the vessels. In Fig. 6 this can be clearly observed even when the vessel is quite small; the vessel appears to be a stem, around which the cells are grouped. In Figs. 2 and 3 this is not so evident; for the most part the alveoli appear to lie between the vessels. It is not always possible to determine whether these vessels contain blood or lymph. Some of them are undoubtedly blood vessels, because the corpuscles can be seen in the lumen.

Thus the most striking features of these tumours is the complexity of the arrangement of the different elements, and hence the difficulty in classifying them. Some of the sections from Case 4 suggested it was a sarcoma; other sections conformed to the types here illustrated. Whether these tumours are endo- or peritheliomata is doubtful. Case 3 is probably of the latter type.

I am indebted to the surgeons named for permission to use their cases, and to Dr. Charlton Briscoe for the photographs.

RUPTURE OF THE GENITAL CANAL DURING LABOUR.

By H. T. HICKS, F.R.C.S. Eng.,

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Rupture of the genital canal, though fortunately rare, is one of the most disastrous accidents which can overtake a woman in labour. In the Guy's Charity, intra-peritoneal rupture has occurred only twice in the last 4 years, and during this period no less than 16,000 deliveries have taken place.

Rupture of the uterus is described in the text-books as being of two main varieties, viz.—complete and incomplete. It seems to me that the terms extra-peritoneal and intra-peritoneal rupture convey a better meaning, because so much depends upon the condition of the peritoneum in relation to the rupture.

I have collected 17 cases of rupture of the uterus, admitted into Guy's during the last 20 years, and 8 of these I have seen personally. Out of the whole number, 14 were intra-peritoneal and 3 extra-peritoneal. Of the 14, the rupture was spontaneous in 6, in 8 it followed delivery by version. In 2 of the latter the rupture was peritoneal only.

In 2 the pelvis was moderately contracted, but in none were the signs and symptoms of threatened rupture of the uterus apparently present. Two out of the 17 were primigravidæ, while the rest were multiparous. Only one case survived intra-peritoneal rupture, and 2 out of the 3 with extra-peritoneal lesions recovered. No doubt this high mortality was, in some measure, due to the fact that the majority of the cases, some of whom had come from a distance, were in a desperate condition when admitted. Dr. Herbert Spencer, in a paper read before the Obstetrical Society of London (*Obst. Soc. Trans.*, 1900), recorded 4 cases of rupture of the uterus, which were treated by plugging the rent with gauze, resulting in recovery, but only 2 of these were intra-peritoneal. In the discussion which followed, Dr. Horrocks spoke of 2

cases of intra-peritoneal rupture, followed by recovery, and Dr. Drummond Robinson added yet another case. These recoveries were intra-peritoneal ruptures, in which the fœtus had been delivered. No one recorded a case of recovery when the fœtus had passed through the rent into the abdominal cavity, but Dr. Munroe Kerr has lately published a case, which ended in recovery, in which the fœtus passed through the rent into the abdominal cavity. The abdomen was opened, the fœtus and placenta removed, and hysterectomy performed (*B.M.J.*, August 24, 1907, page 445).

In comparison with intra-peritoneal rupture, an extra-peritoneal lesion must rank as one of the minor injuries of the genital canal during labour, for its treatment is simple, and the prognosis good.

Intra-peritoneal Rupture.—It is important to recognise that there are two distinct forms of intra-peritoneal rupture, viz. :— (*a*) "Rupture without delivery of the fœtus," which is spontaneous, and, as a rule, quite independent of any manipulative interference ; (*b*) "Rupture with delivery of the fœtus," which almost invariably follows delivery by version, or some other form of forcible manipulation.

(A) INTRA-PERITONEAL RUPTURE WITHOUT DELIVERY OF THE FŒTUS.

The rupture, in these circumstances, may be spoken of as "spontaneous," because, as a rule, some part of the genital canal gives way without artificial interference, and the fœtus passes through the rent into the peritoneal cavity. In a few cases of precipitate labour, however, spontaneous rupture may occur, but the fœtus is so rapidly driven onwards by the excessive uterine action that it passes the rent and is delivered per vaginam.

Of the 6 examples of spontaneous rupture, 5 were multiparous women, one had had no less than 12 full-term children and 4 miscarriages. There was no obvious pelvic contraction present in any of the cases, and there was no evident cause for the delay in the delivery, except in one in which the fœtus weighed 12 lbs., and in two the presentation was right occipito posterior, while in the rest the vertex was apparently presenting normally.

Although there may have been some general contraction of the pelvis, it is quite certain that there was no great obstruction in any of the 6 cases, with the exception of one woman who had previously had 4 full-term children. This patient went into labour with her fifth child, which weighed 12 lbs., and the vagina ruptured spontaneously, and even in this case the symptoms of threatened rupture were absent.

Contracted pelvis, especially the milder degrees, obstruction due to tumours, or faults in the size of the fœtus or the presentation, are commonly associated with rupture because the passage of the fœtus through the pelvic cavity is relatively made more difficult, but we must look to the condition of the walls of the genital canal for the explanation of those cases in which the rupture occurs when the pelvis, the fœtus, and the presentation are normal.

Everyone is familiar with the fact that the lower uterine segment thins out during labour, and the greater the obstruction to delivery, the more marked this thinning becomes, until eventually the wall of the canal gives way. It is clear that, if the wall of the genital canal is weakened by degeneration, it will rupture more easily, and there may come a time when it may not be able to stand the tension of even a normal labour. Multiparity is the great cause of uterine weakness, but chronic renal disease and alcoholism play their part in the degeneration of the uterine as of the cardiac muscle. The part played by contracted pelvis and malpresentations, in the causation of spontaneous rupture, is quite insignificant in comparison with that played by the strength and condition of the wall of the genital canal. For instance, a woman may have had twelve normal labours, yet the genital canal ruptures at the thirteenth; and again, a patient, with slight general contraction of the pelvis, may have many children, but there may come a time when the genital canal fails to stand the extra strain placed upon it, and gives way. In the same manner, a large child, or a persistent occipito-posterior presentation, may cause rupture. I do not know that the microscopical evidence of uterine degeneration is very convincing, but fibroid changes and fatty degeneration of the muscle have been described. I have not been able to convince myself of any

marked changes in the sections, which I have examined. Nevertheless, the clinical evidence that the walls of the genital canal may become so weakened by frequent child-bearing is indisputable. It stands to reason, therefore, that the chief offenders, so far as obstruction to delivery is concerned, are mild degrees of contracted pelvis, malpresentations of the fœtal head, and large size of the fœtus; obstruction, in fact, which a young healthy uterus will overcome, but not one which is worn out with multiple child-bearing, or degenerate from other causes. I do not mean to say that, in first labour, rupture of the genital canal may not be the final result of obstructed labour, with marked contraction of the pelvis, or transverse presentation; but the better knowledge, among present-day midwives, coupled with the timely warning, which the symptoms of obstructed labour give, when a young healthy uterus passes into tonic contraction, will, in most cases, bring the necessary artificial interference and relief before rupture can take place.

Multiparity also predisposes to rupture, because the abdominal muscles lose tone and power. The uterus, therefore, not only loses a considerable amount of the accessory powers of expulsion, but pendulosity upsets its normal axis, and the want of support and deviations from the normal uterine axis must increase the liability to rupture.

Precipitate Labour as a Cause of Rupture.—In 2 cases of the 17, the rupture was undoubtedly due to a riotous uterine action. In one case, a young primigravida, aged 19, labour had only been in progress about twenty minutes when a normal sized living fœtus was expelled with the vertex presenting.

The extern attendant arrived soon after the child was born, and, on failing to deliver the placenta, sent for help. The rent was discovered when the resident obstetric officer passed his hand into the uterus. There was no contraction of the pelvis. The second case is one of great interest, and I had the opportunity of obtaining the details from the doctor in charge of the patient before admission.

A patient, aged 39, who had had four full-term children previously without difficulty, went into labour at 10 a.m., and a child was born within half an hour, the vertex presenting.

The patient did not become collapsed, and the doctor, who arrived soon after the birth of the child, found a second fœtus presenting with vertex. The uterus was in an almost passive state, but the fœtal head seemed to be engaging the brim. The doctor decided to await the return of uterine contractions. After waiting about an hour and a half, he found that the fœtal head was loose in the brim, and it eventually disappeared altogether. The patient did not show any signs of collapse, but the rupture was diagnosed. On admission, her pulse was 100, she was not blanched or collapsed, and her general condition was satisfactory in every way. The fœtus could be felt easily through the abdominal walls with the uterus contracted down to the level of the umbilicus, and there was slight hæmorrhage from the vagina.

The rupture was in front, and on the right, the bladder being much torn. The abdomen was opened at once, and the fœtus removed with the double placenta. The pelvic peritoneum was so much torn that it was decided that hysterectomy would afford the best hope of recovery. The patient did very well for about forty-eight hours, but leakage of urine occurred, and she died of peritonitis about four days later. The first fœtus weighed 6 and the second 5½ lbs. and the pelvis was not contracted. No doubt the first fœtus caused the damage to the genital canal, and the second fœtus passed through the rent into the peritoneal cavity. These two cases illustrate well the dangers of precipitate labour, which must be looked upon as a very definite cause of rupture, and one which it would be difficult to avoid. It is obvious that a large fœtus or a weak uterine wall would also predispose to rupture in precipitate labour, but it may occur when the fœtus is normal and the walls of the genital canal are in a young and healthy state.

Signs and Symptoms of Spontaneous Rupture.—Some of the classical signs of threatened rupture, as given in the text-books, may be present, but, as a rule, in spontaneous rupture there is a complete absence of such symptoms. All the cases of spontaneous rupture where the fœtus was delivered were not diagnosed until the presenting part became loose and disappeared, but there was slight bleeding from the vagina before this happened in two cases, which, however, was not sufficient to raise a suspicion of what was going on.

The pulse rate may rise some time before actual rupture or collapse sets in, but, if the hæmorrhage is not great, collapse may not become obvious until some time after the disappearance of the presenting part. It is true that the uterine pains may cease, because when the uterus is relieved of its tension the pains cease in the same way as when the fœtus is delivered per vaginam. In most cases, therefore, there is absolutely no warning that rupture is imminent, and the first indication that something is wrong is given by the loosening of the presenting part, and perhaps by the general condition of the patient. The absence or presence of premonitory symptoms will depend wholly upon the condition of the walls of the genital canal. If a young healthy uterus has to overcome obvious obstruction to delivery, it will give plenty of warning that rupture is threatening, but a degenerate uterine wall will give way sometimes, whether there be any real obstruction or not, without the least hint until the rupture has actually occurred.

Spontaneous rupture is therefore most often quite unavoidable, and should not call for hostile criticism. Rupture generally takes place at the point of greatest pressure, its direction being transversely to the line of greatest tension. It is therefore generally behind and vertical in the vagina and oblique or transverse in the cervix and the lower uterine segment. The site of rupture is nearly always at the cervico-vaginal junction, extending upwards and downwards to a more or less degree into the lower segment or vagina.

Treatment.—If the fœtus and placenta have passed into the peritoneal cavity, the abdomen must be opened. It is useless to attempt to deliver the fœtus by passing the hand through the rent, seizing the leg, in the hope of dragging the fœtus back through the rupture, and delivering it per vaginam. It must be remembered that the uterus has contracted down, after rupture, and the walls of the genital canal were much stretched by the fœtal head, before the rupture became large enough to allow of its escape into the peritoneum. It stands to reason that any attempt to drag the fœtus back into the genital canal must do further damage. I mention this possible method of delivery of the fœtus, because one might at first sight be tempted to try it, and I have actually seen such an attempt, which, needless to say, was not only a waste of valuable time,

but did considerable damage. The fœtus and placenta must therefore be removed by opening the abdomen. Now comes the question as to what to do with the rent. This depends greatly on its position. If it can be got at, it is best to suture completely. If the whole length of the rent cannot be reached, as much of it as possible should be sutured, and the rest plugged with gauze. The most difficult position will be that part of the rent which involves the peritoneum of Douglas's pouch. In one case I was able to suture nearly the whole of the rupture, even at the bottom of the retro-uterine pouch, but I purposely left an opening for a gauze drain into the vagina. A Hagedorn needle-holder and needle will be found to be the best instrument for suturing deeply in the pelvic cavity, and a continuous, rather than an interrupted, catgut suture will save time, and the Trendlenburg position is necessary.

The direction which the rent takes in the lower segment and cervix is most often oblique, or even transverse, so that it frequently involves the broad ligaments and the peritoneum over them, and sometimes the bladder may be also torn. Where the peritoneum, in relation with the uterus, is involved, the sutures should be placed deeply into the muscular walls to check hæmorrhage, but, when the peritoneum over the cellular tissue of the broad ligaments is torn, the peritoneum only should be brought accurately into position, in the same way as is done in covering over the stump after hysterectomy. To put it concisely, the operator should attempt to convert an intra-peritoneal into an extra-peritoneal rupture. If the general peritoneal cavity can thus be shut off, the rent should be plugged from below in the same way as when the rupture is extra-peritoneal. Before closing the abdomen the peritoneal cavity must be washed out with a large quantity of saline fluid ; but I see no reason for peritoneal drainage.

There is one other important point, viz., hæmorrhage. This may be severe, but, as a rule, it is not. The bleeding generally comes from the torn edges of the genital canal and the veins of the cellular tissue, and will, in most cases, be easily checked by placing the sutures through the whole thickness of the walls of the genital canal, or by actual suture of the bleeding vessel, if in view, and by relying on the plug to

stop the bleeding in the cellular tissue. In a few cases the hæmorrhage is reported to have been severe, a large branch of the uterine artery having been torn. In one specimen I have seen the rupture pass deeply into the broad ligament, right across the line of the uterine artery, which can be seen bridging the cleft like a telephone wire. The main branch of the artery is nearly always able to resist laceration.

Hysterectomy is recommended by some as a routine treatment. If hæmorrhage is severe, hysterectomy may become necessary, but, as a general rule, this operation will add too much to the already existing shock. If the bladder is ruptured, the right treatment is to sew it up, and bring the peritoneum carefully together, so that, if there is any urinary leakage, a gauze plug inserted below will effect satisfactory drainage. The general treatment for shock should be adopted. I think that the above is the best form of surgical treatment. Much, however, will depend upon the rapidity of the operation, and the general condition of the patient. As a rule, the immediate collapse is so great, that there is little hope of recovery whatever is done. On the other hand, the patient may remain in a satisfactory condition for some hours after the actual rupture, and disappearance of the presenting part. Of course, a good light and extra help may not be at hand, and a hospital not within easy distance. In these circumstances, the abdomen must be opened, the fœtus and placenta removed, and the abdominal cavity well flushed out with saline fluid. The rent should then be plugged with iodoform gauze, carrying the ends of the gauze into the vagina, and the abdominal wound closed above.

This operation can be done on the bed, after cleansing the skin as well as possible, and should not take more than 15 minutes. Rapidity of action is often the only hope of saving the patient. In the few cases which I have seen, the shock has been much worse in spontaneous rupture without delivery of the fœtus, than when the fœtus has been delivered by version.

I have already mentioned that any marked alteration of the uterine axis must be looked upon as a predisposing cause of rupture, but I do not think that, apart from fixation by adhesion, simple deviation of the uterus is of great import-

ance. When, however, the uterus is distorted by peritoneal adhesions binding one of its walls down, the uterine axis may become so profoundly altered, during the development of the gestation, that the cervix will not dilate, and the uterus may pass into tonic contraction, and its lower segment rupture. The best example of such a case is found in the adhesions, which form as the result of ventral hysteropexy. If the adhesions are dense, the anterior wall of the uterus is bound down, and, if pregnancy supervenes, the posterior wall develops at the expense of the anterior, so that the fundus uteri does not form the summit of uterus at full term. When labour sets in, the cervix does not sink into the pelvis, but is held high up above the pelvic brim, and, as retraction of the uterine muscle progresses, the posterior wall, being free from adhesions, becomes thinned out. Posteriorly, the cervix is pulled upwards, but the anterior portion remains more or less in its abnormal position. The cervix thus comes to look backwards. The full force of the uterine contraction is borne by the lower part of the posterior wall of the uterus which may give way under the strain. If the adhesions are posterior, the anterior, instead of the posterior, wall will develop during pregnancy, and rupture may take place in the same version.

The following short note illustrates the difficulties that adhesion may cause during labour.

A patient, on whom ventral fixation had been performed four years before, became pregnant. She went into labour at full term, and after twelve hours the os was only dilated enough to admit two fingers, and the cervix, instead of sinking into the brim, remained fixed high up in front. The uterus went into tonic contraction and the membrane ruptured. No progress was made in the dilation of the cervix, and rupture of the uterus seemed imminent. Cæsarian section was performed. It was noted that the uterine incision, although it was made in front, became posterior in half its length when the fœtus was removed. This shows well how distorted the uterus had become. The real fundus uteri had not kept its position at the summit, but had risen with its Fallopian tubes to about half-way up the anterior surface of the uterus a full term. The adhesion had held the cervix and anterior wall of the uterus rigidly while the posterior wall had developed,

and no doubt the latter would have ruptured in a short time if Cæsarian section had not brought relief.

(B) INTRA-PERITONEAL RUPTURE WITH DELIVERY OF THE FŒTUS.

If the fœtus is delivered, the rupture, except in the case of precipitate labour, is nearly always due to forcible manipulations. In performing internal version, the operator, having grasped the leg, delivers the fœtus by this means, so that it does not pass into the peritoneal cavity. I believe that internal version is responsible for at least 50 per cent. of the major ruptures of the genital canal, and transverse presentations are frequently associated with rupture because version is the usual method of rectification and delivery. I am convinced that, whether the presentation is vertex, or transverse, internal version must always be performed with great care, and version is even more dangerous in cases of protracted vertex presentation. How often one sees, or hears of cases in which the fœtal head has been delayed because of want of flexion, or perhaps slight general contraction, and, instead of carefully considering the cause of the delay and its treatment, the doctor applies forceps, and failing to deliver by this means, he performs internal version. He may be successful even in delivering a living child, but it is not worth the great risk he runs of rupturing the genital canal. This sort of midwifery deserves severe condemnation, for, although internal version is an operation of great use, its application is as much abused as is that of high forceps. Version was performed in eight cases out of the seventeen, and judging from the histories, and from what one has seen personally, the rupture in each case was directly due to the version. In four cases, the version was performed to rectify transverse presentations, and, in the other two, it was used as the method of delivery with the vertex presented, because other means had failed, and there was delay in delivery from some slight cause. The pelvis was contracted in one case out of the six. It is stated that rupture of the uterus is more common in multiparous women, because transverse presentations are more frequent. This may be true up to a certain point, but, beyond the fact that a transverse presentation causes greater stretching of the lower segment in

comparison with those in which the fœtus lies in the long axis of the uterus, it plays a small part in the direct causation of the rupture unless it is neglected. The uterus may be ruptured in performing version by the passage of the operator's hand through a tense and thinned-out lower uterine segment, but more often the damage is done by the fœtal occiput, which has to rise when traction is made upon the leg. If the lower segment is tense and thin, or, what is perhaps just as important, if the genital canal is weakened with degeneration, it will give way without the obvious symptoms and signs of tonic contraction. I do not suppose that anyone would perform internal version for transverse presentation, if the uterus was in tonic contraction with the shoulder driven hard down, and the retraction ring high up above the head and shoulder; but there are cases less marked than this, in which it will be difficult to decide whether to turn or not. Put in another way, the operator should have no doubt as to the condition of the lower uterine segment, and should decapitate rather than risk rupture by version.

Treatment.—An immediate diagnosis is not always made. Unless hæmorrhage is severe, collapse may not come on for some time after delivery, and the doctor may have left his patient fairly comfortable, only to be called back in a few hours to find her in a collapsed condition. In one case rupture was suspected because the placenta could not be expressed, and, on passing the hand into the vagina to find the cause, a large rent was discovered in the posterior wall of the vagina and lower segment. In two cases, the rupture was noticed because the douche failed to return. If the above symptoms do not lead to an immediate diagnosis, it will not be long before the pulse rate rises, and collapse sets in.

It is not always easy to feel the soft edges of the rent, because the vaginal and cervical walls hang in loose folds after the birth of the fœtus and placenta. In two cases, the diagnosis was not apparent to the doctors till the omentum appeared at the vulva, and, in one case, the omentum was mistaken for the membranes, but the fatty masses in the former ought at once to distinguish it.

If there is any doubt as to whether the uterus is ruptured, the whole hand should be passed into the vagina and up into

the uterus. The rent will then be readily felt. The hæmorrhage may be only slight externally, but severe internally. If this is so, the patient will soon show signs of collapse.

The prognosis is, of course, very bad, and, needless to say, the earlier the diagnosis is made the better. The prognosis in intra-peritoneal rupture, with delivery of the fœtus, is distinctly better than when the fœtus passes through the rent into the peritoneal cavity.

Treatment.—There is no doubt as to which form of treatment will give the best result. The rent should be plugged with gauze, after first passing a tube through the rent, and flushing out the peritoneal cavity with large quantities of saline fluid. The plug must not be pushed too far beyond the edges of the rent. The uses of the plug are that it prevents the intestine and omentum from prolapsing through the wound; it acts as a drain, and stops hæmorrhage; and it promotes the formation of protective peritoneal adhesions, which shut off the general peritoneal cavity.

In the discussion of Dr. Herbert Spencer's paper, opinions differed as to the length of time the plug should be left *in situ*. Dr. Spencer left the plug three or four days, but I think that 48 hours is sufficient. If left longer, it is liable to promote sepsis. The plug should, if possible, be removed under an anæsthetic, and the vagina may be douched under lower pressure after a few days. The vagina is then packed loosely with iodoform gauze. This constitutes the treatment of rupture of the uterus when the fœtus is delivered. It might appear that suture of the rent is the best surgical proceeding, but it is not possible to completely suture the rent from below, and abdominal section with peritoneal suture from above is too severe a measure for a patient, who is probably already in a critical condition. In some cases, hæmorrhage is severe, and the plug may fail to control it. In these circumstances, if a large vessel is involved, it may be necessary to perform hysterectomy, and, of the two forms, vaginal hysterectomy will perhaps give rise to less shock. If these patients do not die of immediate shock and hæmorrhage, peritonitis frequently carries them off in a few days. In the majority of cases, peritoneal flushing, followed by the simpler application of a plug,

is all that will be necessary beyond the general treatment for shock and hæmorrhage.

If the bladder wall is torn, it should, if possible be sutured, and this may necessitate laparotomy.

Special Forms of Rupture.—In rare cases the peritoneum alone becomes split. These ruptures are generally multiple, and involve the muscle superficially. It is difficult to see how these lesions occur, and probably the peritoneum itself is brittle.

In the two cases among the 17, which I have collected, the accident seems directly due to version. In one of these cases, there were numerous vertical peritoneal splits; in the other, there were only two or three, one of which ran for more than 4 inches across the posterior layer of the left broad ligament. In both cases, at the autopsies about a pint and a half of blood was found in the peritoneal cavity. It is doubtful whether death was actually due to peritoneal lesions, for both patients were already in an extremely collapsed and exhausted condition from a protracted labour. A diagnosis is impossible, but if the signs of internal hæmorrhage are marked, such a lesion might be suspected.

Extra-peritoneal Rupture.—This lesion is probably more common than is supposed, because it may occur without recognition, and is frequently associated with forcible manipulations with a not fully-dilated cervix, such as the performance of bipolar-podalic version in the treatment of placenta prævia, or any form of forcible dilatation of the cervix.

An immediate diagnosis is not often made; more often pain and rise of temperature, a few days later, indicate the lesion. Exudation by this time will have taken place into the cellular tissue followed by infection. On examination, a distinct fulness will be felt in one or other broad ligament, and the rent in the wall of the cervix will be felt by the examining finger.

The prognosis on the whole is favourable. Hæmorrhage is seldom severe enough to call for special treatment, and what danger there is, lies in the question of the virulence of septic infection, which is liable to occur in the cavity of the rent. The fatal case of extra-peritoneal rupture among this series is

an example of the danger of sepsis in extra-peritoneal rupture. The patient was a primigravida, aged 34, who was delivered, with forceps, of a full term, dead, œdematous fœtus, the pelvis being moderately contracted.

A few days later, the temperature rose, and, after a short while, a definite swelling was noticed in the left broad ligament. This was looked upon as infective parametritis; symptoms, however, grew much worse, and, on further examination, a large rent was found communicating between the abscess cavity and the cervical canal, through which two fingers could be passed with ease. Pus was discharging per vaginam, and inflammation spread upwards to the renal and subdiaphragmatic regions, and the patient died of pyæmia on the 28th day of the puerperium.

One must also remember that, if a large abscess forms in the broad ligament, the peritoneum may slough, and a general peritonitis carry off the patient.

The treatment is simple. After washing out the cavity with mild antiseptic solutions under low pressure, the cavity should be plugged with antiseptic gauze. The plug should be removed in 24 hours, the cavity again washed out, and a fresh plug applied. After a few days of this treatment, the plug can be left out altogether, the patient being treated with ordinary vaginal antiseptic douches.

OPHTHALMIA NEONATORUM.

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(*Concluded.*)

III.—THE CLINICAL ASPECT.

When a child is brought with ophthalmia neonatorum, the greatest care should be exercised in the separation of the lids, since it is impossible to say what the condition of the cornea may be, and any undue pressure on the globe may lead to the rupture of an ulcer which is nearly perforating.

The baby should be held by a nurse, the head being placed on or between the knees of the surgeon, who should wear protective glasses to prevent any chance of infection of his own eyes. Naturally the most careful antiseptic precautions, with regard to the hands, etc., should be used after examining such a case.

Having separated the eyelids, and washed, or wiped, away the discharge, the cornea should be first examined, for, if it is found clear, a good prognosis may be given, as I shall point out later when speaking of this complication. The palpebral conjunctiva, in severe cases, is red and swollen. Its surface is much papillated. Occasionally, in mild cases, there is much follicular formation, especially in the lower fold. The ocular conjunctiva, as a rule, is not so much affected, and, unlike gonorrhœal cases in the adult, shows practically no chemosis, which is probably due to the fact that the infant's eyes are always closed, whilst, in the adult, it is the ocular conjunctiva, in the palpebral fissure, which is principally œdematous, the swollen lids causing a certain amount of constriction.

It is impossible to say with certainty, without a bacteriological examination, what organism is the actual cause of

the infection, but, if a case comes with a profuse, thick, creamy discharge which, in the later stages, becomes flocculent, with a very little mucus in it, one can almost say with certainty that it is gonorrhœal, more especially if the cornea is affected, since the other organisms do not attack the cornea, as a rule, with the exceptions, perhaps, of the streptococcus and the Klebs-Loeffler bacillus.

On the other hand, if a case comes with a slight discharge and red lid margins, the skin around the lids being affected, the infection is probably due to the Morax Axenfeld bacillus. This latter organism rarely occurs alone in infants, but is usually associated with the staphylococcus albus, and, therefore, contrary to what is the case with adults, the discharge is often a slightly purulent one.

Conjunctival false membranes are not at all infrequent in infants. I have seen them associated with the gonococcus, Koch-Weeks bacillus, the streptococcus, and Klebs-Loeffler bacillus, and it is quite impossible to say, without the aid of the microscope, to which of these organisms they are due, although in the latter two organisms the membrane is usually more adherent to the conjunctiva, at any rate in the early stages.

Diagnosis.—The diagnosis is usually very simple, but there is one condition, which is really a complication of the disease, which may be mistaken for it; that is so-called congenital lachrymal obstruction[1] with a large purulent mucocele. In these cases, usually one eye only is filled with pus, whereas ophthalmia neonatorum generally affects both eyes. Pressure over the lachrymal sac will cause regurgitation of pus into the eye, and so render the diagnosis easy. As a rule, although the sac may be very distended, there is no swelling to be seen over the lachrymal area, as the fat cheeks of the infant hide it. Although it would seem impossible to miss such cases, I have heard of instances where the conjunctiva has been painted for weeks with nitrate of silver for a purulent mucocele.

Treatment (Prophylactic).—In discussing the sociological question, we have already seen that the decrease in the disease, since 1881, was due to the adoption of the method

[1] Mayou: *R.L.O.H. Reports*, 1907.

used by Crédé, published by him in that year. The next question, which arises, is with regard to the best method of carrying out the prophylactic treatment. With the idea of finding out the method adopted, and the results obtained, I wrote to all the lying-in institutions of this country with the following results. In all cases, directly the head is born, the lids are wiped free from secretion, generally with wool soaked in 1 in 2,000 of perchloride of mercury, and, as soon as possible after birth, one of the following applications made to the conjunctival sac :—

Hospital.	Treatment.	Result.
British Lying-in - - -	Perchloride, 1–2000 for 3 days -	·09
Rotunda Hospital, Dublin -	Perchloride, 1–2000, and $AgNo_3$	·02
	(Silver has recently been abandoned, 1905.)	·009
Birmingham Lying-in - -	Perchloride and $AgNo_3$, 1 per cent.	·07
Glasgow Maternity Hospital -	$AgNo_3$, 1 per cent., or protargol, 10 per cent.	1·00
City Lying-in Hospital - -	Perchloride, 1–2000, $AgNo_3$, 5 grs.	·16
General Lying-in Hospital, York Road.	HgCl., 1–2000 - - -	·39
Queen Charlotte Lying-in Hospital.	$AgNo_3$, gr. v. - - -	1·6

Dr. Howe gives the following results from the use of the prophylactic method obtained from German statistics :—

Births.	———	Per Cent.
24,724	2 per cent. solution of nitrate of silver - -	0·65
1,223	1 „ „ „ „ „ „ „ - -	2·4
1,623	Carbolic acid solutions - - - -	7·7
965	0·1 per cent. solution of sublimate - - -	0·6
1,396	Other sublimate solutions - - - -	0·4
6,155	Sterilised water - - - - -	2·8
701	Iodide trichloride solution - - -	1·2

From these results, it will be seen that perchloride of mercury, 1 in 2,000, and silver nitrate, 2 per cent. solution

hold the first place in these statistics. The former has the advantage of being carried in every midwifery bag; nitrate of silver also has the disadvantage that it deposits silver when it is kept in solution for long. In order to obviate this, protargol has been used by the midwives of the Glasgow Lying-in Institution, with a similar result to that given by the 1 per cent. solution of nitrate of silver, but the number of cases, as given by Dr. Henderson, in the statistics of this Institution, seems to be unusually high. Although perchloride of mercury seems to be equally effectual, nitrate of silver is the drug which is most used, the 2 per cent. solution being the most satisfactory. It is dropped into the conjunctival sac, and should be subsequently neutralised with salt solution, as there is no lachrymal secretion in the child at birth.

The supposed objections which have been raised to the use of nitrate of silver in prophylactic measures are:—

(1) Conjunctival reaction;
(2) Conjunctival hæmorrhage;
(3) Corneal opacities;
(4) That it does not prevent ophthalmia neonatorum;
(5) The moral objection.

1. *Conjunctival Reaction.*—Without doubt, conjunctival reaction usually follows the application of nitrate of silver, and a slight discharge comes on from one to four hours after the application, and usually lasts for about 48 hours. As I have already pointed out, it is to this reaction that its beneficial effect is partly due, causing the protective layer of lymphoid cells to be formed early; one can hardly therefore regard this as an objection to the use of the treatment. Zweifre has shown that the use of sodium chloride, to neutralise the effect of the nitrate of silver, lessens the amount of the discharge.

2. *Conjunctival Hæmorrhage.*—Abbe, Schweinitz, Pomeroy, Hansell, and Nettleship have all met with cases of hæmorrhage after birth, when nitrate of silver has been applied. Koudiche records a case of conjunctival hæmorrhage, in which silver nitrate was not applied at birth. Indeed it seems very doubtful if these cases have any direct connection with the application of the silver nitrate. Undoubtedly, some of the cases, which have been recorded, were hæmophilic in character,

since two of the cases subsequently died of hæmorrhages elsewhere.

A condition which may give rise to conjunctival hæmorrhage, and which may be overlooked, is the presence of polypi, originating from the inner end of the fornix, of which I have seen two cases in new-born infants, one of which (in which the infant was still-born) I examined pathologically, and found full of blood. It had evidently been formed by the nipping of the fold of conjunctiva at the inner end of the fornix between the lid and the globe. The hæmorrhage into it may possibly have resulted from trauma at birth.

3. *Corneal Opacities.*—In four cases have corneal opacities, supposed to be due to the silver nitrate, been recorded, two by Cohn in his collected statistics; but in neither of these cases was it possible to find out the strength of the solution used, nor how it was applied. In one case by Van de Bergh and Rominiee, the cornea was injured, and in one of these, and probably in both, the solutions used were too strong.

4. Undoubtedly Crédé's method does not entirely prevent ophthalmia neonatorum, because it cannot prevent ante-partum infection, or secondary infection, although the risk of the latter is probably much reduced by the rapid formation of lymphoid tissue. But that it prevents birth infection, in most cases, has been previously shown. In one case, however, which I examined, it did not do so. The mother had been suffering from a vaginal discharge for two months before pregnancy. This was known by the doctor, and she was frequently douched before labour came on. Directly the child was born, the eyes were washed out, and silver nitrate applied and neutralised, but, in spite of this, severe ophthalmia neonatorum developed on the third day, containing the gonococcus.

5. There is yet another false objection to this treatment, which perhaps is responsible for the majority of cases of the disease still existent in this country; that is, the supposed slur cast on the character of the parents of the children. Only about 65 per cent. of the cases are due to the gonococcus, and, as infection may take place after the birth of the child, this seems to me sufficient to do away with this objection, taking into account also the serious nature of the disease,

if it does occur. At a discussion before the Gynæcological Society, nitrate of silver was objected to by some practitioners, because of the discharge which it causes for the first 48 hours, but, as has been pointed out, this is very slight, if the silver is neutralised. It was therefore suggested that perchloride should be used for every case, and the nitrate of silver be reserved for those cases, in which it was known that a vaginal discharge had been present before labour. Dr. Herman was of opinion that the latter was the more trustworthy.

With the idea of finding out with whom the fault lay in failing to carry out prophylactic treatment, I investigated 162 confinements, which had been followed by ophthalmia neonatorum in the infant, the onset being before the third day so as to exclude so far as possible cases of secondary infection. I found that 90 had been attended by medical men, and 72 by midwives, a point which speaks strongly in favour of the present efficient training of midwives. But there is still much to be done in the way of emphasising the serious nature of the disease to both these parties (*e.g.*, by a clause in the Midwives Act).

Doctor or Nurse.	Total No. of Cases investigated = 162.
Attended by Doctor.	Attended by Nurse.
90	72

Curative Treatment.—Fuch says, "If a case comes under treatment in season, that is, while the cornea is still intact, that latter can almost to a certainty be maintained in a healthy state." E. Treacher Collins says that a case of infantile ophthalmia, when first seen, should be in its worst stage, and that it begins to improve immediately under treatment.

In 326 cases from the Royal London Ophthalmic and Central London Ophthalmic Hospitals, in which 91 cases had developed corneal affections, five only occurred whilst under treatment. In all these cases, the patient was absent from daily treatment at the hospital from one to four weeks, the corneal ulceration having developed during such absence. It may, therefore, be said that *if a case is seen early enough, the cornea can be saved.* Unfortunately, the patient is often

brought to be treated far too late, when the corneæ have necrosed, and the sight is gone for ever.

With the idea of finding out when the attendance is usually made, I investigated 322 cases, of which 70 per cent. were brought during and after the third week; that is to say, when the mother was able to get up and bring the child herself to be treated, unfortunately often too late to save the sight of the infant. Whilst official notification of this disease would no doubt be the best way to ensure early treatment of a case, some arrangement would have to be made for isolation as well as treatment. By far the most satisfactory would be the provision of an infectious ward, in connection with ophthalmic hospitals, where the infant could, and, if necessary, the mother, be admitted. In Liverpool, in connection with St. Paul's Eye and Ear Infirmary, it is proposed to build such a ward for the treatment of these cases. (*B.M.J.*, April 5, 1907.)

Failing this, a department, where the infants can be brought daily for treatment, such as that at Moorfields, yields good results, but only of course when attendance is made regularly.

There can be no doubt that the sheet anchor of the treatment is nitrate of silver. At Moorfields, in cases of any severity, a 2 per cent. solution is painted once daily over the lids and fornices. In mild cases, protargol, 10 per cent. solution, can be used as drops at home, if properly instilled. E. Alvarado, in collected results of European surgeons, recommends nitrate of silver in preference to protargol for the majority of cases. In the intervals, the conjunctival sacs should be washed out every hour with a solution of 1 in 8,000 of perchloride of mercury. The lotion should be used cold, or even iced, as the cold inhibits the growth of the gonococcus, and, at the same time, prevents excessive swelling of the lids. In painting, wool mops on the end of glass rods, which should subsequently be carefully sterilised, are used. The nitrate of silver should be rubbed into the conjunctiva of the tarsus and fornix, so that the drug may reach the bottom of the papillæ, which are very marked in the gonococcal form of the disease, but the greatest care should be taken not to damage the corneal epithelium. The excess of silver should

be neutralised with salt solution. A supply of wool should be given to the nurse to wash away the discharge from the patient's eyes, and to burn directly after use. The nurse should be warned against the risks of infection, and the greatest care should be taken whilst washing the child, the head being washed separately, and all towels, sponges, etc., for its use, kept separate. Protective glasses should be worn by the nurse and the surgeon examining the case, as, when the eyelids are separated, discharge will often spurt some distance from between the lids. If only one eye is affected, the greatest care should be taken to prevent the infection of the other. The sound eye should be covered by a Buller's shield, or better perhaps in infants, by a cyanide gauze sealed down on the nasal side by flexile collodion or strapping. It should be inspected for the first few days to see that the infection has not taken place. The treatment should be continued anyway with the lotion, for at least a month after all the discharge had ceased, since the gonococcus has been found by Groenouw 28 days after the discharge has subsided. It must also, therefore, be treated as infectious during this period. According to Axenfeld, the papillary hypertrophy, which is so marked, disappears entirely, leaving nothing from which you can say that the child has had ophthalmia neonatorum. Stephenson does not agree with this view.

The duration of treatment varies considerably according to whether the case is severe or mild. If mild, the case is usually free from discharge by the end of the second week of treatment; if severe, the average duration of treatment was six weeks, in 200 cases investigated.

With the idea of trying to shorten the attack, anti-gonococcus serum (horse) was tried in the early stage of 4 cases, both locally, hypodermically, and per rectum without definite result.

In one case a vaccine was prepared and administered without result.

IV.—COMPLICATIONS.

The complications are (1) *local*, and (2) *general*.

1. *Local.*—Infection of the *cornea* is by far the most important complication which arises, and it is due to this

complication that sight is so frequently destroyed. The cornea is involved in two ways clinically:—(1) *haze;* (2) *ulceration.*

Frequency. — In 326 cases of ophthalmia neonatorum attending at the Royal London Ophthalmic and Central London Ophthalmic Hospitals, from 1902 to 1906, the cornea was implicated in 90 cases; that is to say, 27 per cent. Both eyes were affected in 47 cases, that is, 14 per cent., and one eye only in 41 cases, that is, 12 per cent. Of these cases, 27 affected the right eye as compared with 16 in the left. In the 47 cases involving both eyes, 21 resulted in total loss of sight, or 44 per cent. In the 137 corneæ affected, 43 were affected with haze, that is, 32 per cent., and 94 with corneal ulcers, that is, 68 per cent.; of these latter, 30 were known to perforate.

Tyrrell (E. T. Collins) gives the following tables for the years 1900 and 1901 at the Royal London Ophthalmic Hospital:—

——	No. of Cases.	Ulceration of Cornea.	Percentage with Injured Eyes.
1900 - -	77	One eye - 14 / Both eyes - 15 } 29	37·6
1901 - -	91	One eye - 12 / Both eyes - 15 } 27	29·6
	168	56	33·3

In the majority of these, the opacity cleared up, leaving only a small nebula.

Fuchs, 1885, gives the following, principally from German sources:—

Author.	No. of Cases observed.	Affection of Cornea.	Blindness of both Eyes.	Percentage of Injured Eyes.
Heyman - -	108	43	0	39·8
Hirschberg -	200	55	6	27·5
Schöler - -	156	43	(?)	27·5
Heyman -	139	25	(?)	18·0
Emrys Jones -	420	72	16	17·1

As we have already seen, the cornea in the infant can be saved from infection if the disease is properly treated, and, in

this respect, it differs from gonorrhœa in the adult, where, in spite of every care, the cornea cannot always be saved. The reason for this is, I think, the anatomical condition of the cornea at birth, which differs very considerably from that in the adult.

The *epithelium*, I have already shown, has no flattened layer on the surface, and therefore probably affords less protection. But the *substantia propria* is very much thicker in the newly-born as compared with the adult, both actually and relatively as compared with the sclera.

The *lamellæ* do not seem to be so tightly bolted together, since they can be more easily torn apart. As a result of this, there is much more free circulation of lymph through its substance containing protective bodies, and better paths for the migration of leucocytes, and hence better protection against infection; the latter also accounts for the haze, which is seen so frequently before actual necrosis takes place. When once necrosis of the cornea sets in, perforation often takes place with extraordinary rapidity compared with adult cases, probably due to the greater softness of the tissue in infants. The subsequent clearing up of opacities in the cornea is no doubt due to the free supply of lymph, and the subsequent flattening of the scar by the growth of the cornea.

1. *Haze.*—The corneal haze is the clinical condition which often precedes corneal ulceration. For instance, I have the notes of three cases which, on the day of attendance, had corneal haze in both eyes. One eye in each subsequently developed a severe corneal ulcer, whilst the other cleared up entirely. This haze, therefore, represents the early stage of infiltration of the cornea by polymorphonuclear leucocytes as the result of infection; if this infection is arrested, resolution takes place; if it is not, necrosis follows. I have the notes of a number of cases in which resolution took place. Although the haze, as a rule, clears entirely, I have the notes of two cases in which corneal opacities were left (when examined two months later). One can only suppose that there had been necrosis without true ulceration followed by cicatrisation. It is possible also that slight degrees of haze may be produced by the nitrate of silver.

2. *Corneal Ulceration* seems to be of two types: (1) Small

localised ulcers ; (2) large ulcers causing necrosis, practically involving the whole cornea. Both these forms lead to perforation, the former frequently, the second always ; the former resulting in a leucoma with a portion of clear cornea left, and possibly an anterior polar cataract, while the second leads to total anterior staphyloma. Granulations at the site of perforation form more frequently in infants than in adults, probably owing to the loose structure of the cornea in the infant.

Hypopyon seems to be comparatively rare, but owing probably to the rapidity with which perforation takes place, it is not always noted.

The organism par excellence, which especially affects the cornea, is the gonococcus, and, with the exception of two cases, one due to the staphylococcus, and the other probably to the meningococcus, it is the only organism which I have found, but there have been cases recorded of corneal ulceration, caused by the streptococcus, Klebs-Loeffler bacillus, and the pneumococcus.

Directly there is any suspicion of the cornea being affected, atropin should be instilled into the eye to dilate the pupil, and the treatment carried out as described before with every care.

3. *Rhinitis.*—This complication of ophthalmia neonatorum is very little recognised, and yet it undoubtedly occurs. H. L. Lack has examined the nose in a number of cases of ophthalmia neonatorum. In some of these, there was a definite purulent rhinitis, in which was found the diplococcus similar to that found in the eye (gonococcus). This organism was also found, in a few cases, in the nose, with practically no discharge, although there was a quantity of discharge from the eye ; in by far the larger number of cases of ophthalmia neonatorum due to the gonococcus, no organism can be found in the nose, a fact which is probably due to the small lumen of canaliculi at birth not allowing the pus to travel in sufficient quantities to set up infection in the nose.

4. Seligsohn, Panas, and Terson have all reported cases in which the lachrymal gland was infected. It became much swollen, and, in one case, suppurated.

Enlargement of the preauricular gland is very frequent.

Suppuration has been recorded by Berger, but it seems to be rare.

5. Local inoculation by the carrying of discharge from the eye elsewhere is rare in infants, and although vulvo-vaginal discharge in female children does occur, probably the infection takes place at birth.

GENERAL COMPLICATIONS.

1. *Arthritis.*—C. Lucas (1885), first showed that arthritis followed gonorrheal infection of the eye in the newly-born. Gonococci were found in the joints. This has been since confirmed by numerous observers. (Deutschmann, Altland.) It seems most frequently to attack the knee joints. In one case which I have seen, the knee joint was tapped, and a quantity of clear fluid flaked with lymph was drawn off, but no definite organism was found in this case. The discharge from the eye contained the gonococcus.

2. Meningitis and peritonitis have been recorded as secondary infections through the blood stream from the eyes of these infants.

3. Murray (*Ophth. Review*, 1902, p. 53) reports a case of gonococcal endocarditis secondary to ophthalmia neonatorum. These cases are extremely rare.

LITERATURE.

I have not attempted to give a complete account of the Literature of this subject, which is enormous, but all the principal papers are mentioned, and marked with an asterisk so that, by looking up these, the older literature can be reached.

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A NEW METHOD OF INTESTINAL ANASTOMOSIS, SUITABLE FOR CASES OF GANGRENOUS INTUSSUSCEPTION.

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[With Plates VIII. and IX.]

The statistics of recovery after operation for intussusception have recently very much improved; but this has been due, not so much to advance in the technique of the operation as to the fact that cases are diagnosed earlier, and are more promptly dealt with. Attempts to reduce the intussusception, by injections of gas or fluid, are almost entirely given up, and a laparotomy is usually performed at the earliest possible moment; and statistics show that, where the intussusception can be reduced without rupturing the bowel, the prognosis is distinctly good. The cases, however, in which the intussusception has been so tight, or has persisted so long that the intussuscepted portion of the bowel has become gangrenous, still show a very high mortality, at least 90 per cent., and very few cases are reported in which, after resection of a portion of the bowel, the patient has recovered. This statement, of course, applies mainly to infants, as it is very rare to find acute intussusception in any but very young children; and while, in adults, excision of the whole of the gangrenous portion, with anastomosis of the ends of the bowel, is often feasible, in children the age of the patient usually precludes this method of treatment. Two methods for dealing with this condition have been devised, which immediately, or almost immediately, restore the continuity of the bowel. In one, which has been devised by Mr. Barker, a longitudinal incision is made in a healthy part of the intussuscipiens. The whole of the intussuscepted portion is then drawn out through this incision, and the congested mass of bowel cut away. The ends of the bowel are united after the manner of Maunsell's operation, and reduced through the opening in the intussuscipiens. The incision in the intussuscipiens is then closed, and the abdominal

wound sutured. The other method consists in imitating the natural cure, the intussusception is made a little more complete, and the adhesion between the intestinal walls, at the mouth of the tumour, made more secure by a few stitches; the abdominal wound is then sutured, and, in a favourable case, the gangrenous portion is passed as a slough.

It is, of course, quite possible to bring both ends of the bowel out into the wound, tie in a Paul's tube, and wait for an improvement in the patient's condition to perform an enterectomy. Unfortunately, however, this leaves the patient with an artificial anus communicating with the small intestine, as a result of which there is not only irritation of the patient's skin, but, owing to the loss of the intestinal contents before absorption is completed, the patient usually succumbs to marasmus. In any case, the risks of the second operation are considerable, especially in young children. The present operation is devised in order to obviate, so far as possible, the disadvantages of these methods, and to offer an operative procedure with a reasonable chance of recovery. This method has the advantage that, while it is best performed with the specially devised instrument, it can be done with instruments that are always at hand during any operation.

After the intussusception has been reduced, as far as possible, a point is reached where the bowel is gangrenous, and any further attempts at reduction lead to rupture of the gut. The whole of the gangrenous and ruptured portion is then pulled right up out of the wound, and a cloth lightly and rapidly packed over the surface of the wound so as to keep any other coils of intestine from coming out. An aneurysm needle is then taken, bearing a stout catgut ligature, and passed through the mesentery, close to its point of attachment to the bowel, selecting a point where the bowel is obviously healthy. The ligature is then carried across the mesentery, and passed through a corresponding point in its attachment on the other side of the gangrenous portion, in such a way that tightening of the ligature completely cuts off the blood supply, not only to the portion which is actually gangrenous, but also to a small extent of healthy bowel on each side. The whole of this loop is then cut away, and, after the contents of the bowel have been allowed to escape, the two cut ends are pulled up a

little further into the wound. The special enterectomy forceps (Fig. 1) are then taken, and one blade thrust downward into each end of the open gut.

The relationship of the blades to the bowel wall is adjusted, so that when the forceps are closed two surfaces, opposite the mesenteric attachment, will be brought into apposition. The forceps are then closed, so that these two surfaces of bowel are pressed firmly together, and the portions, within the grasp of the forceps, completely deprived of their blood supply; the two blades thus acting like the two halves of a Murphy's button. A certain amount of local peritonitis is set up around the area nipped by the forceps, which is sufficient to cause the bowel surfaces to adhere to one another. Within this area the portion which has been compressed sloughs, and ultimately completely comes away, leaving a wide lateral anastomosis between the two portions of intestine. When the forceps have been closed, the specially constructed Paul's tubes (Fig. 2) are tied into position. These tubes bear on that portion of the convex surface which goes inside the bowel, a longitudinal depression, which exactly fits the arm of the forceps, so that it is possible to insert a tube into the bowel, and tie it in place with the arm of the forceps lying in the groove of the Paul's tube.

The instrument is arranged to bear two Paul's tubes so that each end of the bowel may be drained. While, in many cases, it is only the upper end of the bowel which needs drainage, yet, in the hurry of an operation, it is very easy to make a mistake about the relationship of the intestine, and, furthermore, when the obstruction has been very acute, it is quite possible for the distal end of the bowel to contain a very fair quantity of fæcal matter. If it is not thought advisable to drain both ends of the bowel, a ligature is tied round the distal portion, including the arm of the forceps, completely occluding it. A few stitches are then inserted between the skin and the bowel wall, so as to shut off the peritoneal cavity, and hold the forceps and intestine in position; a dressing can then be applied. The most difficult point in the application of the dressing consists in the arrangement of the gauze and wool so as to support the forceps, and prevent them dragging or pressing on the intestinal contents. In order

to do this, a slit is cut in the first piece of gauze, allowing it to be wrapped round the forceps and tubes, and yet lie flat upon the abdominal wall. A large piece of gauze is then taken, and unfolded, so as to form a sheet about 2 feet long and 18 inches wide. This is spread out upon the sterilised towels, and a mass of wool laid along its longest side. The wool is then rolled up in the sheet of gauze, so as to form a cylindrical pad about 2 inches in diameter, which can be rolled round the forceps and tubes, forming an efficient pad for their support. Any further dressings that may be considered advisable can then be arranged, bandages applied, and the patient put back to bed. The tubes will loosen in about thirty-six hours, and can then be removed, but the forceps must be left in position for a week.

About the third day, sloughs will be noticed escaping from the opening of the bowel, indicating that the process of absorption of the portion of bowel within the grip of the forceps has commenced. At the end of the week the catch on the forceps is carefully undone, and the instrument removed. The after treatment is exactly the same as that of a colotomy, but it will be found, in a few days, that the patient will pass a very considerable amount of fæces per rectum. When the passage of fæces by the normal channel has become well established, an attempt should be made to occlude the opening into the bowel, so far as possible, by packing the gauze into its opening, thus minimising the irritation of the skin, produced by contact with the intestinal contents.

The patient is then in possession of an uninterrupted intestinal canal, communicating with the exterior by a fistulous track. This is of course very far from being a normal condition, but it is vastly superior to that in which the patient has an opening of the small intestine upon the abdominal wall, through which the whole of the intestinal contents escape.

Although there is no positive evidence that fæcal fistulæ, produced in this manner, will close spontaneously, experience of other fæcal fistulæ makes it quite a justifiable assumption that this would very frequently happen, and, in any case, the fistula could be repaired by an extra-peritoneal operation, a procedure much less fraught with danger in a young child than a cœliotomy.

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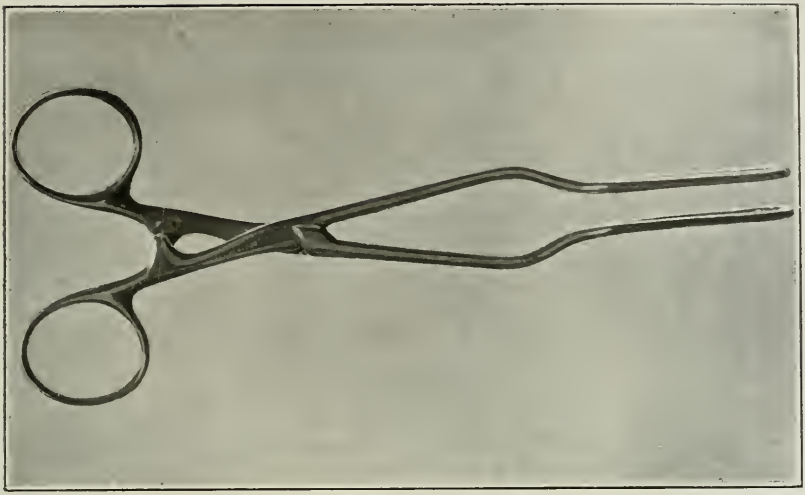

Fig. 1.—*The enterectomy forceps.*

Fig. 2.—*The modified Paul's tube.*

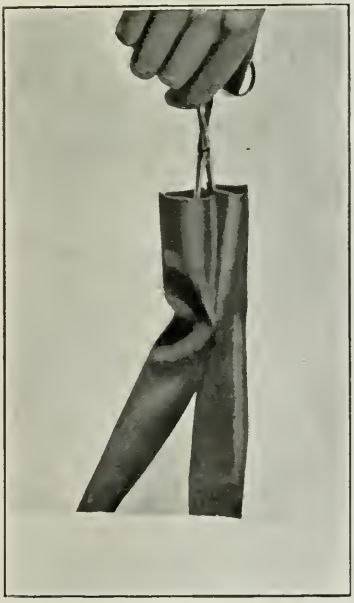

Fig. 3.—*Method of inserting the forceps. The instrument is shown applied to two pieces of the thin india-rubber tube used for draining "colotomies."*

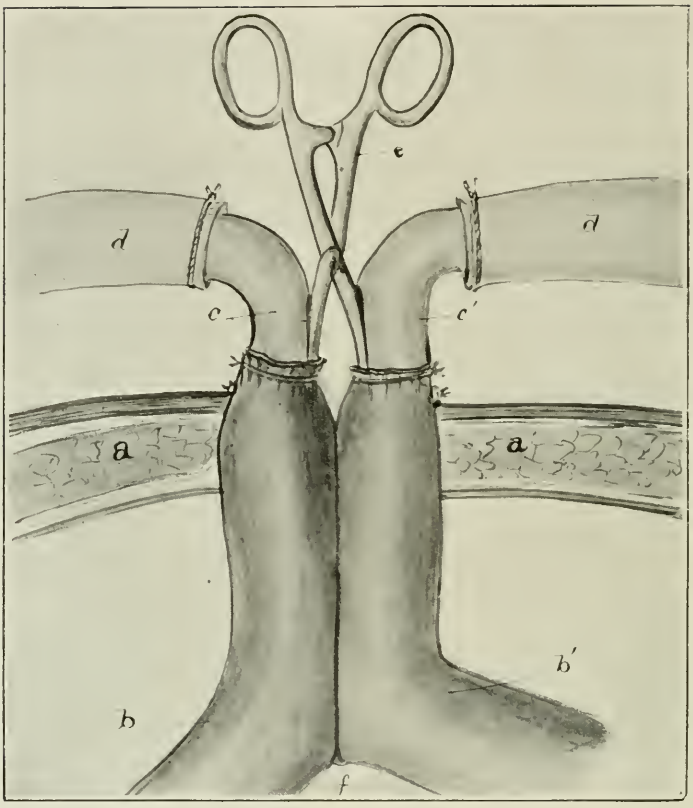

Fig. 4.—*Diagrammatic reproduction of the completed operation.*

a. *Abdominal wall.* b, b. *The two ends of the bowel—the mesentery is omitted for the sake of simplicity.* c, c. *The Paul's tubes tied into position.* d, d. *The india-rubber tubes which convey the bowel contents away into a suitable vessel.* e. *The anastomosing forceps. The drawing suggests that there is tension at the point* f, *where the two portions of intestine meet; actually, of course, there is no such tension, as the angle between them is more acute.*

Fig. 6.—*Specimen removed from case described. Glass rods have been placed inside the two portions of intestine.*

This operation can probably be best performed with the apparatus described above, but if this is not to hand, a pair of ordinary tongue forceps may be employed, though this,

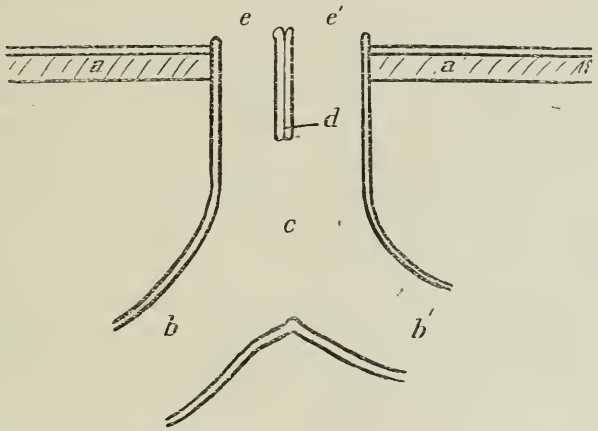

Fig. 5.—*Diagrammatic section through the bowel and abdominal wall, showing the anastomosis.*

a, a. *Abdominal wall.* b, b. *The two loops of bowel.* c. *The opening produced by sloughing of the tissue within the grasp of the blades of the forceps.* d. *The septum left between the arms of the forceps.* e, e. *The two fistulous openings into the bowel.*

of course, does not allow the Paul's tube to be used. If, however, the bowel has been well emptied at the time of the operation, and has been secured by a few extra stitches to the skin, the absence of the Paul's tubes does not necessarily mean failure. Especially is this the case in infants in whom peritoneal adhesions form with much greater rapidity than in adults, so that, although there may be some troublesome infection of the skin, the risk of septic peritonitis is not very great.

The specimen shown in Fig. 6 was obtained from a patient ten weeks old, upon whom this operation had been performed, the actual instrument used being a small pair of Silk's tongue forceps. The patient was suffering from an intussusception, which presented signs and symptoms so equivocal that it was not recognised until reduction was impossible. The process of intussusception had carried the tumour over the left iliac fossa, where it could be felt as a small rounded tumour about the size of a walnut; it was not palpable per rectum. When the

abdomen was opened, it was found that there was a small but very tight enteric intussusception, involving about 5 inches of the small intestine about 6 inches from the ileo-cæcal valve, into the cæcum. It was found possible to reduce the tumour as far as the ileo-cæcal valve, but the bowel then began to tear, and it was obviously hopeless to attempt any further reduction. The whole loop was then pulled out and dealt with according to the procedure described above. The child was rather collapsed, after the operation, but by means of saline infusion and stimulants, the collapse was satisfactorily tided over, and the child made, for a time, a most excellent recovery.[1]

The child was kept at the breast for the first week, but then it happened, very unfortunately, owing to sudden and severe illness of the child's father, that the mother was unable to continue the nursing, and an attempt to wean the child promptly gave rise to digestive disturbances. As soon as possible the child and the mother were taken into hospital together, and an attempt was made to restore the efficiency of the mother as a wet nurse by rest and a generous diet; this produced a very marked improvement in the child's condition, but the digestive disturbance never completely recovered, and although the child actually begain to gain weight it collapsed, and died five weeks after the operation.

At the time of its death, the abdominal wound had nearly healed around the opening of the bowel, and the child was passing much more fæcal matter per rectum than through the wound. In the photograph of the specimen, it will be seen that the cæcum and the small intestine have been brought very satisfactorily into union, and that, so far from there being any constriction at the point of anastomosis, there is actually a dilated cavity, lined with mucous membrane at the point of junction of the two portions of the bowel.

Although this is the only case in which I have had an opportunity of operating upon these lines, and, although the ultimate result of the operation was unsatisfactory, I feel that sufficient measure of success was attained to warrant a descrip-

[1] The saline infusion was commenced at the same time as the operation, as I have found that this is an exceedingly valuable method of preventing shock. I usually run in one or two ounces under the anterior wall of the axilla

tion of the operation, affording as it does a rational method of dealing with cases which were previously almost, if not absolutely, hopeless.

It is obvious that this method has a wider field of application than gangrenous intussusception. Many cases of strangulated hernia contain a loop of gangrenous small intestine, and it frequently happens that the patient's condition, and the surroundings, in which the operation has to be performed, quite prohibit any attempt at an intestinal anastomosis, the surgeon having to content himself with opening the loop of intestine, and leaving the patient in a most unsatisfactory condition. With this method, it would be possible to deal with a bad case of strangulated hernia in a small cottage, and without skilled assistance, leaving the patient with his intestinal canal restored in its continuity, and without a permanent artificial anus leading from the small intestine.

FUTURE LINES OF TREATMENT: THEIR EFFECTS ON THE PROFESSION.

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The changes in medical and surgical treatment which have been made during the last thirty years have been enormous, so that it is difficult to realise the fact that a student at that time never saw a case of appendicitis operated upon; that stones were always cut out, and not crushed; that throat, nose, and ear surgery was unknown; that the study of bacteriology had not commenced; that aseptic and antiseptic treatment was just beginning; that diphtheria was treated without antitoxins, with a fatality constantly appalling; that lung cases, including phthisis, were treated in ill-ventilated and hot rooms; that almost all abdominal operations were fatal; that alcohol was administered in large quantities for all acute cases, and ordered also in many chronic ones; and so one might go on with a wearisome tale. Many of us have had to almost relearn our profession.

Of course, all these great changes of treatment have been more or less gradual, but can be traced back to two or three great principles. The first, perhaps, that occurs to us, is Lister's great teaching, that pus is not only unnecessary, in all wounds, whether natural or artificial, but also is harmful, and often deadly in its effects. To all of us here it is almost incredible that we should have lived these nineteen centuries of the Christian era and not to have discovered this fact.

Moses wrote quite clearly about the power of heat to destroy disease; we applied this power in many ways to preserve our foods, but when it came to the presence of pus, we called it laudable! The second great advance was the promulgation of the Public Health Acts, which have been since amended and extended in many ways. To-day, the health of every town and village is more or less under the

supervision of a special medical officer. The third important advance has been division of labour among medical men.

Among other great events, which have affected our treatment, is the study of bacteriology, with all its ramifications, by means of which the real causes of disease are ascertained; for, instead of calling all diseases by one of its leading signs or symptoms as in the past, such as peritonitis, meningitis, pleuritis, we place a distinguishing adjective in front, as septic, tuberculous, pneumococcus, influenzal, etc., thereby placing the diagnosis on a scientific basis, and often following it by a correct treatment. Although we have not yet been able to trace the origin of all our diseases, yet we believe that a great and successful beginning has been made, which must sooner or later be followed by even greater advances.

Once more, and this will suffice for our present purpose, the teaching now, in many of our elementary and public schools, of the laws of health will, before long, have an enormous influence in affecting the well-being of our nation, and preventing many diseases which now come under our care. Whatever our private views may be as regards Mr. Birrell's late Education Bill, we must all feel that the people at large lost much by its rejection, in regard to those provisions in it, which put the teaching of the physical part of our nature on a proper footing.

Now coming to the *present time*, it may be asked, What are the lines of treatment that are particularly engaging our attention, and to what end are they leading?

Many things that I am going to say you may not agree with, still, they are worth thinking and pondering over.

First let me take the subject of *Anæsthetics*. Surely it ought to be an unnecessary risk, as well as an unscientific procedure, to render a person wholly insensible in order to operate on a small area of the body. It is well known that many of the fatalities in connection with general anæsthesia have occurred in most trivial local complaints.

Local anæsthesia is only at present in its infancy, but I have already read and seen enough to prophesy that, within ten years, all minor operations will be performed by means of its aid, and, where this method cannot be used, that some such method as that known as spinal anæsthesia will be adopted.

There must be some cases which will require the whole body to be made insensible for some reason or another; at the same time I believe and hope that it will not be the rule.

Secondly, the Treatment of Consumption.—We know, to our own pecuniary cost, what enormous advances have been made in the treatment of this disease.

Sanatoria for consumptive patients are spread all over the country, and our consumptive patients flock into them, but I believe that, when these sanatoria have educated the people at large to the great value of fresh air, and to the following out of the natural laws of eating, clothing, and exercise, their existence to a great extent will cease. After all, people are sent to sanatoria *with* consumption, and surely the main point in reference to this disease is to prevent its occurrence; this prevention will be brought about, to a large extent, by teaching everyone, especially the children, the absolute necessity of ventilation in all houses and public buildings.

Although consumptive sanatoria were first started on a scientific basis abroad, especially in Germany and Switzerland, yet, strange to say, the value of fresh air is more appreciated in this country than it is abroad. One has only to notice the absence of proper ventilation in almost all foreign railway carriages, in the hotels, private houses, and especially in the chalets in which the peasants live, and to compare this with our own system in order to estimate its superiority. There is one great drawback to the sanatorium treatment, which is only just being appreciated, viz., the strong possibility, and almost probability of producing loafers, especially among the working class. This is a subject upon which much might be said, but it has already been noted, and in some sanatoria work is now provided for the inmates.

Whilst on this subject of ventilation, it should be observed that, when all children are placed in well-ventilated rooms, and taught to breathe properly through the nose, the operation for the presence of adenoids will be a rare one. I think that there is already a noticeable decline in such operations, and that they are growing in disfavour.

On the Subject of Therapeutics.—There is an absolute revolution in ideas. To a great extent this has been brought about by the nauseous medicines prescribed, and by the

uncouthness of our past dispensing methods. Homœopathy has had a great deal to do with altering some of our views as to the administration of drugs, both from a dosage and cosmetic point of view. Then we were tied hand and foot by our antiquated British Pharmacopœia. There soon sprang up all the great American firms — the English following somewhat slowly in their wake—with their tabloids, standardised solutions, elegant preparations, and also constant introduction of fresh drugs. To-day, we hardly know where we stand. Nearly all medical men condemn the present system, for they say that the chemists are supplying them with drugs, instead of therapeutists telling the manufacturers what to compound. This is only partially true, for many of the best firms employ qualified medical men, and also obtain their information direct from practising physicians. Still, I would always rather prescribe from the British Pharmacopœia, if possible, but to-day it is almost impossible to wholly do so, for many reasons that are obvious.

But there is a point, in connection with this subject of therapeutics, which is seriously affecting our profession, namely, the ease with which the public can obtain every kind of drug, for every kind of trouble. The harm, apart from ourselves, that is being done, is great, for people quickly fall into the habit of drugging themselves to their serious injury.

The present Treatment of Cancer is far from satisfactory, although the dangers connected with operations for it have disappeared, and its earlier removal has somewhat prolonged life; but when one looks back over twenty or thirty years, and recollects all the cases of malignant disease that one has seen operated upon and the results following, one is obliged to admit an immense amount of failure and constant disappointment. The reason of this is plain, for one is attacking the disease, so to speak, at the wrong end, and I have little doubt that some of us will live long enough to see a real and permanent preventive method established. Again, another example of treating a disease late in its course is that of appendicitis. I have already written upon the prevention of *appendicitis*, and am writing more, but I will simply say here that the disease is purely one of civilisation, that it is increasing absolutely and relatively to the population, and that, appa-

rently, the only treatment, which at present holds the field, is the operative one. Surely it is worth while, nay it is imperative, that the causes of this disease should be studied, and that it should thus be prevented, or treated quite in an early stage. The operative method, although often effective and curative, is a serious one. It is done at a late and complicated stage of the disease, and, as in many cases of cancer, it cannot be considered scientific, and can only occupy a temporary position.

Much the same might be said about the operative treatment of *gastric ulcer*. It seems to me, here again, that we are constantly discussing, or rather that the papers are, the advisability or not of operating upon many cases of the above, and constantly forgetting that most of these gastric ulcers should be prevented, or else cured in their earlier stages.

No one disputes the urgent advisability of operative interference in cases of rupture of gastric ulcer, and most men would agree that there are a few cases of chronic ulceration, in which the pain and misery are so great, that an operation is wise.

Gastric ulcers, we know, occur very largely in anæmic young girls of the servant class. Do we sufficiently recognise the seriousness of anæmia in young people? I think not. Every anæmic person should be looked upon potentially as having a gastric ulcer, and the anæmia treated at once and continuously, at the same time the diet should be carefully attended to. When it is possible, hospital treatment, with its rest, diet, and general nursing, is of the greatest use.

Once more the *milk question* and its relationship to children. Children have been dying by the thousands for years past from diarrhœa due to contaminated milk, and the full remedy for arresting this death-rate has not yet been applied.

If people had stopped to think about the past and present method of milk feeding in children, and to compare it with Nature's method, legislation on this question would long ago have been made effective and curative. We all have known, and watched how a baby takes its mother's milk; there is the natural warm and soft pillow of the breast for the child's head to lie upon, the milk is of the right temperature, contains all the necessary nutriment, and passes direct from the mother

to the child, with no possible chance of obtaining any bacterial infection *en route*. Now compare this with the milk, which is obtained from the cow, and trace its passage to the child, from the udder through the hands of the milker to the can ; from here it often travels in carts or in trains, or in both, to the milkman's shop, then through all the dangers from the shop to the nursery, one does not wonder that, after the vicissitudes through which the milk has passed, boiling it should be considered necessary. Some day milk will be sent direct from the cows, and retained in a sweet and uncontaminated condition, until it reaches the child or invalid, without the necessity of altering its full nutritive and antiscorbutic properties by boiling or sterilising it.[1] When the above comes about, we shall see a great diminution of diarrhœa in children, and our astringent medicines will be little required.

Let us now, for a few moments, consider what in future will be the trend of the teaching of medicine and its future effects on the members of our profession. It is always difficult to prognosticate, still, from what has already been said, and from the manner in which practitioners are already affected, it can be safely inferred that some great changes, such have already been in the past, are probably in store in the future.

We shall not continue to spend thousands, nay almost millions, on hospitals, dispensaries, infirmaries, sanatoria, inebriate and drug homes, etc., to treat mostly patients who have diseases far advanced, of which the cure, in many cases, is doubtful. Our out-patients system will have to be radically altered, for half the patients that are seen under it are suffering from troubles and complaints due to ignorance on the part of themselves, or of their parents who bring them up.

Everything is now tending, and will do so more and more, in the direction of the teaching of hygiene and temperance, especially to the young. At the meeting held in London, on April 24, 1907, Lord Strathcona presiding, convened by a joint committee of the Board of Hygiene and Temperance, the Hygiene and Temperance Committee of the medical

[1] See a description of "A Scientific Worked Dairy Farm," *British Medical Journal*, January 2, 1904.

profession, also the Health Committee of the British Medical Association, there were speakers from all parts of the world, and nearly every one mentioned what immense results had taken place from the teaching referred to. The following resolution was moved and carried, that "This Conference is of opinion that to meet adequately the responsibilities of the State towards school children, it is essential that a medical department should be instituted by the Board of Education."

Now all this preventive teaching of medicine, which will increase more and more, is being brought about by ourselves for the destruction of ourselves.

It is one of the most extraordinary occurrences of the present day, that a great profession is digging its own grave. Yet to be honest we must dig it. But what is going to happen to us? A great deal has already happened. Our *dispensing* to a great extent is gone. For slight ailments patients treat themselves, or their friends do it for them.

Nurses take on a great deal of work, including midwifery, that medical men once did. Masseuses, electricians, quacks, such as corn cutters, skin specialists, and many such like, take another large share of our work, and to-day there is no doubt whatever that the total amount of strictly medical and surgical work done by our profession is less than it was 20 years ago relatively to the population.

I think then that there must be, if men are going to gain their livelihood by practising the medical profession, fewer men admitted to its ranks, and these highly qualified. There will be more and more state-supported men in all branches of medicine. This has already occurred in connection with many of our public bodies.

Honorary appointments to public institutions will become considerably fewer in number, and in future be replaced by paid ones. Co-operative methods, as in all other business and professions, wherever possible, will come about. The best example of this is the club system, which has been in vogue now for many years. I cannot conceive that the in-patient system of our hospitals will be much affected. For, in my opinion, patients are treated in them by such methods that it is almost impossible for them to have anything like the same advantage at their own homes. In large towns,

nursing homes compare favourably with our hospitals, but even here the expense is often almost prohibitory.

Much is heard at the present day of the lowly estate of the medical profession, of the neglect with which it is treated by governments, principalities, and powers, of the imperfect appreciation of its services shown by the public, and of the manifold wrongs which it suffers at the hands of Society.

That there is solid ground for dissatisfaction in respect of all these things is a statement which cannot be refuted.

It may, however, be pointed out that these are partly to be found in the operation of economic laws, which affect in the same way, as they affect every other profession or industry, partly in the uncertain nature of the knowledge on which the healing art is largely based, partly, too, in the new conception of the true function of the physician, which is almost imperceptibly being produced by the evolution of scientific medicine.

As medicine approximates more and more to the character of an exact science, its chief aim tends to change from the cure to the prevention of disease. In the defence of the public health, its most conspicuous triumphs have been won, and in that direction lies the hope of its future expansion.

It is certain that, when a knowledge of the general principles of physiology and of the laws of health is the common property of all men and women, the belief in futile remedies will cease, and quackery will die a natural death. Medicine will no longer be looked on as the art of curing disease, but as a science of preventing such of them as cannot be altogether abolished.

That such an existence of things as described above is far off, we must all admit, still we have only to compare the present with the past in order to see and appreciate what we have left behind, and what we enjoy to-day.

In that far-off time, to which I am referring, the physician will take the place that rightly belongs to him, as the most important functionary in an enlightened state.

A REVIEW OF DISEASES OF THE BLOOD, AND BLOOD-FORMING ORGANS.

By H. BATTY SHAW, M.D., F.R.C.P.

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(*Concluded.*)

II.—TREATMENT.

So important are the histolytic changes produced by Roentgen-rays, that it seems justifiable, in this review, to consider, under the heading of treatment, the advances which have been made in the direction of clearing up the problems which have arisen as to how these agents work, and how these effects may be controlled and regulated, when applied in the treatment of blood diseases. This is the more necessary because, since the paper, published by Senn, attracted American observers' attention to the possible usefulness of Roentgen-rays for reduction of splenic tumours, and for the reduction of the white corpuscles of the blood, enthusiasm has been aroused even amongst the more critical Continental workers. These, though at first sceptical of the alleged good results, are now acknowledging by the contribution of most elaborate researches on the action of Roentgen-rays in normal and pathological conditions, that this mode of treatment must be accepted, more especially in leucocythæmia, as one of the most efficient which medical science has so far advanced. What, at one time, looked like an empiric method of cure, has now most assuredly become one of great scientific importance. Myelocytic leucocythæmia, which has in the past worn none but a most sinister prognosis, has again and again been shown to respond favourably to treatment by Roentgen-rays, the actual number of cases reported numbering about 150.

The existence of certain cells, in various parts of the body and in the blood stream, which, by their increase and accumulation, can, in the former case, produce enlargement of all lymphatic tissues, including the lymphatic glands and the spleen, of various other organs, such as the liver, kidneys, and

salivary glands, and which can also lead to a complete transformation of the marrow of bones, even to producing a myelomatosis of the bones, has long ago led to the view that the efforts of the surgeon, in this direction at least, can never be expected to effect a cure of what are known as cases of leucocythæmia. The various forms of leucocythæmia possess, by their peculiar feature of being based upon the hitherto little accepted pathological principle of metaplasia, a malignancy, if anything worse in certain cases than that of carcinoma or sarcoma ; notably is this the case in those forms of the disease which are known as acute leucocythæmia.

Arsenic, which is a potent agent, capable of acting as a protoplasmic poison, has long been used as a remedy in leucocythæmia ; but the determination, until the advent of the study of Roentgen-rays when applied to the same diseases, of the reason for the apparent usefulness of the drug has been the despair of the pharmacologist, who had previously been quite unable to give scientific support for the practice from experimental inquiry, or from study of the effects produced in cases of fatal arsenical poisoning. In view of the marked effects, mostly favourable, when properly regulated, of the application of Roentgen-rays in leucocythæmia, it does not seem unreasonable to suppose that both arsenic and Roentgen-rays produce their favourable results by the development of necrosis, which singularly, but certainly, seems to be restricted to certain types of leucocytes, possibly whilst these cells are circulating in the blood, or when undergoing formation in certain cell-centres, or during both phases of their existence. In the past it has been felt by some workers that the effects of arsenic can be controlled to a nicety by regulation of the dose, though every physician has probably met with unfortunate examples of idiosyncrasy, and can cite disastrous results following even most moderate doses of arsenic.

The lesson is being slowly but surely learnt that Roentgen-rays are of the greatest value in controlling the pathological phenomena associated with certain forms of leucocythæmia, not only as a result of the successes, but also by means of the failures, which have followed the application of Senn teaching (*New York Medical Journal*, 1903, I., p. 665, and *Medical Record*, 1903, II., p. 281).

Before proceeding to refer to the efforts of British, American, and Continental workers to date, in the direction of advancing knowledge as how to best regulate the dose of Roentgen-rays by special technical methods, reference must be made to some fundamental principles which seem to have been thoroughly established. Lossen (*Wiener Klinik*, 1907, Heft 2, 3, and 4, February–April), in a thoroughly critical essay, has summarised the established facts, and supplied a mass of literary references which are invaluable. Not only does he supply a trustworthy digest of the results of the application of Roentgen-rays in diseases of the blood, but has practically summarised all that is known of the effects produced, not only upon the hæmopoietic organs and the cells they produce, but upon other quite unrelated tissues, so that it is possible for the reader to learn, not only the good that may be done, but also the irreparable harm effected by an injudicious, uninformed use of Roentgen-rays. It seems to be indubitably established that the properly regulated application of this agent produces in myelocytic leucocythæmia :—

(1) a reduction of leucocytes ;
(2) a reduction of the enlargement of the spleen quickly, or after the lapse of some weeks ;
(3) an increase of the red cells and of the hæmoglobin ;
(4) an improvement of the general health, and an increase of body-weight.

The reduction of the leucocytes is most remarkable, for it appears that the Roentgen-rays lead to the reduction first of those cells which by their presence entirely alter the blood-picture from the normal—the myelocytes which undergo reduction even to the degree of suppression in the circulating blood, with the result that the total leucocyte count approximates closely to the normal, not only qualitatively but quantitatively ; the foreign white corpuscles appear to be particularly more susceptible to the application than their more hardy brethren—the normal circulating leucocytes. This peculiarity is brought out very clearly by the less favourable results following the application of Roentgen-rays to lymphocytic leucocythæmia ; in these cases, the following results, as a rule, occur :—

(1) There is a reduction of the total leucocytes of the blood ;

(2) the enlarged glands also undergo a reduction in size;
(3) the improvement of the general health is less marked than in myelocytic leucocythæmia;
(4) although the total number of leucocytes is reduced, the abnormal percentage of the lymphocytes is *maintained*.

Very many cases of lymphatic leucocythæmia are quite refractory to such treatment.

It is established that, whilst all normal leucocytes are sensitive to such prolonged exposure to the Roentgen-rays as has been found safe, the immature leucocytes, such as the myelocytes, are much more amenable to the necrotic effects produced by this agent. With regard to the other diseases which are usually included under the heading of blood-diseases, such as Hodgkin's disease, splenomegaly, polycythæmia, and pernicious anæmia, much less encouraging results have been obtained, the enlarged glands or organs may for a time be influenced, but recurrence and refractoriness are frequent, and, moreover, there is no associated improvement in the general health and strength.

So far, it has not been established why it is that in certain cases, even amongst the myelocyto-leucocythæmic patients, completely permanent results have not been obtained. Evans (*American Medicine*, 1904, II., p. 279) reports the results of Roentgen-rays in two cases of this form of the disease, one was apparently cured, the other improved in general health only, showing on one occasion, during treatment, an increase, and not a decrease, of the total leucocytes. The difference in the results obtained in different forms of blood disease is well illustrated in a paper by Joachim (*Zeitschr. f. klin. Med.*, 1906, Bd. LX., s. 27). He treated, with Roentgen-rays, 10 cases of myelocytic leucocythæmia, 6 cases of lymphocytic leucocythæmia, 2 cases of atypical leucocythæmia, and 10 cases of Hodgkin's disease. In all the cases of true leucocythæmia, there was a reduction of leucocytes, especially of myelocytes, in those cases in which they were present, the lymphocytes responding much less and, after a certain period of exposure, failing to undergo further reduction. Dock (*American Medicine*, 1904, I., p. 1083) gives a *résumé* of 29 cases of leucocythæmia, collected from the literature. He found that only about two-thirds of the cases showed a fall in the leucocyte

count, as a result of the exposure, and sounds a word of warning in his observation that the treatment had not, at that date, been carried out long enough to speak of a cure. He counsels, during treatment, frequent blood examination, and careful estimation of the uric acid output. The reason for this latter piece of advice will be seen in a subsequent section. The destruction of leucocytes by Roentgen-rays appears to go hand-in-hand within limits, like that accompanying digestion, with an increased output of uric acid; in harmony with this fact, Rosenberger (*Münch. med. Wochenschr.*, 1906, No. 5, s. 209) was unable to demonstrate any increase of the output of uric acid, after the application of Roentgen-rays to cases of Hodgkin's disease, a disease which, as already stated, does not show material alteration of the total leucocytes, as a result of the application of Roentgen-rays. It is well known that certain forms of leucocythæmia, which, on former occasions usually reacted favourably to this form of treatment, will, in ill-understood circumstances, fail to react, and reports are published in which death even has occurred during a course of exposure. Flesch (*Deuts. med. Woch.*, 1906, No. 16, s. 619) reports three cases, one of myelocytic, and two of lymphocytic leucocythæmia, all of which died despite the use of Roentgen-rays, but all these fatalities may be explained on the ground that lymphocythæmia is, as a rule, refractory, especially if the increase of lymphocytes is so great as to produce, by the outcrowding of red cells, such a severe form of secondary anæmia as to render life from a pure want of hæmoglobin impossible. Flesch's case of myelocytic leucocythæmia showed, during treatment, a transformation to the lymphocytic type, so that really this fatality was not an example of the refractoriness of myelocytic leucocythæmia.

Considerable importance is attachable to the degree of surface of the body, which undergoes exposure to the Roentgen-rays, and variation in this detail may account for the variation noted by some observers, from the general results already specified. This is well shown in an important and exhaustive contribution by Benjamin, v. Reuss, Sluka, and Schwarz (*Wien. klin. Woch.*, 1906, No. 26, s. 718), who have shown the variation in the blood picture, according as part or whole of the body of the animal experimented upon is

exposed to the influence of the Roentgen-rays. In the former case, the *status quo ante* of the blood picture was resumed in about twenty-four hours, whereas, in the latter case, the interval required before the normal picture returned was from seven to ten days.

A problem which presents itself, and which is one of great scientific interest, is that of determining why it is that exposure to the Roentgen-rays should have such different effects upon the different cells which come under their influence. It is well known that over-exposure will cause burns and pigmentation of the skin, but it is possible to avoid this difficulty, and yet retain the necrosing effect of the rays upon the deeper-lying centres of leucoblast formation. The discussion of this question raises the important inquiry as to how it is that Roentgen-rays act at all on any kind of cell. In a review of this kind such a discussion would occupy more space than can be allowed, but the consideration of how the rays produce a reduction of leucocytes is one which may be reasonably entertained.

The parasitic nature of leucocythæmia has been frequently discussed, but, so far, no observer has brought forward any direct proof of the existence of such a cause. Moreover, the study of the effects produced by Roentgen-rays, in an indirect way, practically disposes of such a suggestion, for it has been shown experimentally that similar results occur, such as the reduction of leucocytes, when Roentgen-rays are brought to bear on the bodies of healthy animals, as when they act upon leucocythæmic patients. Moreover, similar reduction by Roentgen-rays occurs when artificial leucocytosis is evoked by such non-infective agents as turpentine, pilocarpin, etc. Much controversy has arisen as to whether the Roentgen-rays operate by actually destroying the circulating leucocytes, or by inhibiting their production, in various leucoblastic centres.

Rosenberger (*l.c.*), in agreement with Königer (*Deuts. Arch. f. klin. Med.*, 1906, Bd. LXXXVII., Hft. 1 and 2, s. 31), considers that the Roentgen-rays operate rather by producing inhibitory effects upon leucoblastic centres, and this belief is supported by the observation that a diminished output of uric acid follows the earlier increased output of the same

metabolite under Roentgen-ray treatment, the diminished output being alleged to be contemporaneous with the more gradual destruction of leucocytes, yielded but slowly by leucoblastic centres. There can be little doubt, however, that the early increased output of uric acid is associated with a destruction of the circulating leucocytes, and that, as Lossen (*l.c.*) says, the truth is that, whether circulating or developing, the sensitive leucocytes suffer necrobiotic changes as a result of the effect of the Roentgen-rays.

Hesitation may arise as to whether it is justifiable to accept the view that the increased output of various nitrogenous metabolites is due to disintegration of leucocytes, but doubts on this point will be dispelled by the following facts collected by Lossen (*l.c.*). After exposure to Roentgen-rays, leucocytes have been seen undergoing disintegration in the blood, when examined immediately after removal. Blood-films of leucocythæmic patients undergoing this treatment show a larger proportion of moribund leucocytes than films taken when the treatment has not been carried out. Blood leucocytes and the pus cells of purulent exudation show, after exposure to Roentgen-rays in vitro, less activity and more degeneration than when not so exposed, and leucocytes, which have been similarly treated, show less power of resistance to the disintegrating effects of anisotonic solutions than do leucocytes not so treated. These observations apply more especially to polymorphonuclear cells, and much more so to the specially sensitive myelocytes. As Lossen points out, no definite rules can be laid down as to the behaviour of eosinophil, mast cells, or lymphocytes when exposed to Roentgen-rays. Chemical investigations also point to the close association of disintegration of leucocytes with an increased output of uric acid and of purin bodies, but, as already shown, this output is not necessarily commensurate with the fall of the total number of leucocytes; an explanation for this apparent anomaly being found in the greater power of the individual, by means of less exhausted leucoblastic centres, to produce more leucocytes, and this behaviour has been used as a sign of prognostic value—the result of Roentgen-rays being considered more favourable according as the uric acid output is still kept at a high level, whilst the leucocytes in the blood are reduced in

number. This contention, however, is denied by Morgenstern (*Münch. med. Woch.*, 1906, Nos. 22 and 22, S. 1009, 1063), who sees in the maintenance of a high uric acid output, in the face of a falling leucocyte-count, the disappointing effect of Roentgen-rays on red cells, which would make this particular result of unfavourable prognostic significance. Under ordinary therapeutic restrictions, the output of phosphoric acid is not increased, but, experimentally even, this indication of excessive cell-degradation may be demonstrated. Lossen finds that the histological evidence that Roentgen-rays cause a destruction of leucocytes in leucocythæmia, is rendered unsatisfactory because of the well-known fact that a post-mortem examination of the tissues of leucocythæmia gives abundant evidence of spontaneous destruction of hæmal cells without the intervention of Roentgen-rays, so that it is impossible to properly apportion the amount of spontaneous, as compared with the therapeutic, disintegrative effects. Experimentally, however, the reading is much clearer, and Roentgen-rays have been clearly shown, in certain intensities of exposure, to produce annihilation of Malpighian bodies in the spleen, and of the lymphocytes of the spleen, lymphatic glands, intestine, and thymus. The leucocytes of the marrow are also capable of being reduced, but the red cells of this tissue appear to be resistant ; with greater exposure even the latter disintegrate. A final problem, which requires a satisfactory answer before complete conviction of the action of Roentgen-rays can be secured, is the question, How does this agent effect the changes, which result in an increased output of nitrogen ? Of all the suggestions which have been made, none seems so probable as that which attributes the effect to the liberation, within the cells concerned, of some ferment or ferments, which, operating from within the cell, act as katabolic agents not only upon the cytoplasm and the hyaloplasm, but upon such nitrogen-endowed histological elements as those which constitute the cell nucleus.

Investigations have shown that, under certain physiological conditions, and also in pathological conditions, such as leucocythæmia, polymorphonuclear cells are true ferment carriers. Such cells are capable of undergoing, not only an internal autolysis, but also, when their intracellular ferments are liberated

are capable of giving to the blood-stream trypsin-like enzymes which are able, at suitable temperatures, to digest media composed of serum smeared with ascitic fluid (*Erben, Zentralbt. f. innere Med.*, 1907, No. 3, S. 81). This observer has shown that the blood of myelocythæmia yields a tryptic ferment, and Schumm has demonstrated that such simple end-products of proteid digestion, as leucin and tyrosin, may be demonstrated in incubated blood-serum taken from patients suffering from myelocythæmia. The blood, withdrawn from patients suffering from lymphocythæmia, is unable, in similar circumstances, to give evidence of such digestion, which harmonises with the fact that tryptic ferments have not been demonstrated to exist in lymphocytes. Jochmann and Müller (*Münch. med. Woch.*, 1906, No. 41, S. 2002) have shown that lymphatic glands do not undergo autolytic changes, unless they are the seat of inflammation, and contain polymorphonuclear cells. The ferments present in the myeloid series of cells, as opposed to the lymphoid series, which do not possess ferments, have been shown to be destroyed by boiling, and by the action of Kaiserling's solution (Jochmann and Ziegler, *Münch. med. Woch.*, 1906, No. 43, S. 2093). They are still found to be active in tissues preserved by means of formalin or spirit. Tissues, removed from leucocythæmic patients, and preserved in spirit for twelve years, could still exert a digestive effect upon Loeffler's serum, on exposure to a suitable temperature. This action of liberated ferments may well explain such unexpected phenomena, occurring in leucocythæmia, as œdema, and the fatty degeneration of heart muscle, and other parenchymatous tissues—effects which are difficult to explain on any other ground. Pfeiffer has also studied this question of the action of the ferments of myeloid cells (*Wien. klin. Woch.*, 1906, No. 42, S. 1249). He finds that auto-digestion of a given tissue proceeds to the greatest length when placed in leucocythæmic blood, less in blood, which shows the occurrence of leucocytosis, and, least of all (though quite definitely after longer exposure to incubation), in normal blood. The demonstration of such action, in vitro, must not, however, lead to the deduction that similar processes occur in cases of leucocythæmia. Even under such unfavourable conditions, the body is able to marshal anti-ferments, which circulate

in the blood, and it is only after the failure of this protection from causes, which are still unknown, is it possible for such disintegrative processes as the digestion of proteid to take place. Eppenstein (*Münch. med. Woch.*, 1906, No. 45, S. 2192) found that normal blood serum and plasma were capable of inhibiting these digestive processes, and, so far as his investigation in a case of myelocytic leucocythæmia went, the serum in this condition was still able to check such action. Others have found even that the serum of myelocytic leucocythæmia had a greater anti-ferment action than normal serum. In common with the anti-bodies, developed against such organised ferments as bacteria, these anti-ferments, are inhibited by exposure to a temperature of 55°—60° C. Müller and Kolaczek (*Münch. med. Woch.*, 1907, No. 8, S. 353) have been able to show that the presence of free anti-ferments, in tuberculous and other non-purulent effusions, and the absence of free anti-ferments, in purulent exudations, may be used as a means of differentiation of various suspect fluid effusions.

The fluid, obtained in the former cases, like the normal serum, contains free anti-ferments, that of purulent ones contains anti-ferments indissolubly linked with the autolytic ferments of disintegrated leucocytes, so that digestion of Loeffler's serum by leucocytes is possible in the presence of liquor puris, and not in the presence of the serum composing tuberculous and other non-purulent effusions.

The pathological action of autolytic ferments, in various blood diseases, must be limited to the mere destruction of various tissues. It is impossible to think that any effects are due to the toxic action of the products of such digestion, for it is known that the deep digestion of proteids, by tryptic and other ferments, leads to the development of but feebly toxic bodies, if we except the depressor action, which seems to be common to so many of them. Musser and Edsall, however, point out that the action of Roentgen-rays in cases of leucocythæmia, which they studied (*University of Pennsylvania Med. Bulletin*, 1905, Vol. XVIII., No. 7, p. 174), led to the development of some unknown toxic bodies, which were probably responsible for the production of sterility and albuminuria.

Whether or no Roentgen-rays produce proteolytic bodies

capable of disintegrating all proteids through the above alleged action of liberated digestive ferments, the fact remains that they seem to produce solvent bodies, as shown by the papers of Curschmann and Gaupp (*Münch. med. Woch.*, 1905, No. 50, S. 2409), Linser and Helber (*Münch. med. Woch.*, 1905, No. 15, S. 689; XXII. *Kongress für. innere Medizin*, 1905, S. 143; *Arch. f. klin. Med.*, 1905, LXXXIII., S. 479). Roentgen-rays appear to lead to the production of veritable "leucotoxins." Normal leucocytes, exposed in vitro and in vivo to the action of such leucotoxins present in the serum of animals, which have been exposed to Roentgen-rays, undergo a specific disintegration, such action being destroyed by the exposure of the leucotoxins to a temperature of 60° C. for half an hour. The first effect of the injection of Roentgen-ray leucotoxins is to produce a leucopenia lasting 1—1½ hours, comparable with that produced by the injection of a foreign serum, or of proteid, and probably explainable as a negative chemiotactic effect. This leucopenia is succeeded by a return to the normal, but in about 4—5 hours from the time of the injection, a characteristic Roentgen-ray hypoleucocytosis occurs. Klieneberger and Zöppritz (*Münch. med. Woch.*, 1906, Nos. 18 and 19, S. 850 and 911) have, however, challenged the truth of these observations, for they found that this third stage was not observed when they tested human leucocytes derived from pus, transudates, exudates, normal and leucocythæmic blood, and leucocytes, obtained from rabbits and guinea-pigs, after exposure to the so-called "Roentgen-ray sera" obtained from cases of leucocythæmia, lymphadenoma and lymphasarcoma.

Milchner and Wolff (*Dert. klin. Woch.*, 1906, No. 23, S. 747), have endeavoured to clear up the apparent contradiction in the results of these workers as to the existence of leucotoxins, and finally in their paper quote an experiment made on the effect of injection of Roentgen-rayed spleen-substance which supports the contention that leucotoxins are capable of being developed.

If the work of Curschmann and Gaupp and of Linser and Helber is to be accepted, then it must be assumed that when Roentgen-rays lead to the dissolution of leucocytes by means of their endogenous ferments, the latter are liberated, and thenceforward are capable of leading to a dissolution of other

leucocytes, and other cells, in fact an *heterocytolytic*. A still more recent paper by Mosse (*Münch. med. Woch.*, 1907, No. 5, S. 203), shows that this latter position is untenable, and he found that, not only lymphocytes, but also the various leucocytes, present in bone marrow are incapable of leading to the dissociation of the proteids of such different tissues as that of the lung, judging by the amount of non-coagulable nitrogenous substances, produced in the interaction of such cells and tissue. However, though Mosse concludes that the ferments contained in leucocytes are, under ordinary conditions, unable to act as heterocytolytic ferments, he points out that, under pathological conditions, this law may not hold. This latter guess has not so far been confirmed or contradicted.

Although it must be admitted that the ætiology of leucocythæmia, and other blood diseases, is still obscure, and that, even if it is allowed that Roentgen-rays have, under proper control, been repeatedly shown to produce good effects, or no harmful ones, the mechanism by which such possible results are brought about is enshrouded in mystery, a review on this subject must refer to alleged cures, for reasons already given that, prior to the introduction of the Roentgen-ray treatment of this group of diseases, all other means of cure had been signal failures. So long as the treatment is carried out along the lines proposed by Rosenstern (*Münch. med. Woch.*, 1906, Nos. 21 and 22, S. 1009, 1063), no harm can be done and good may ensue. The treatment must be carefully controlled by frequent blood examination, including the estimation of red cells, hæmoglobin and leucocytes. A watch must be kept for the general improvement of the patient, and, moreover, determination must be made of the output of uric acid, of the purin bodies, and, according to some, of the phosphoric acid.

It is much less certain that Roentgen-rays can be of use in those blood conditions, in which the poverty or exuberance of red cells is a feature, rather than an increase of white ones. No good effects could be expected to follow the use of Roentgen-rays in polycythæmia, because, as already observed, such an intense application as is necessary to produce destruction of red cells is therapeutically impossible; exposure

to a less intensified dose has no effects whatever on red cells. Aldrich and Roy Crummer (*Journ. of the American Med. Assoc.*, 1907, Vol. XLVIII., No. 14, p. 1163) report a case of polycythæmia, in which a reduction of red cells occurred as a result of treatment by means of Roentgen-rays *and of arsenic.* Variable results have been obtained in pernicious anæmia. Rénon and Tixier (*Bull. et Mém. de la Soc. de Med. de hôp. de Paris*, 1906, p. 260) report a case of pernicious anæmia, which was made worse by the use of arsenic; the blood-picture, however, was greatly improved by the use of Roentgen-rays. If anti-diphtheritic serum was also injected to correct the leucopenia, produced by the Roentgen-rays, the improvement was still greater. It must, however, be admitted that the continued improvement of red cell count up to a total $2\frac{1}{2}$ millions, and the restoration to a normal hæmoglobin percentage, were also secured by the use of the serum alone.

That it is possible, however, for the application of Roentgen-rays alone to be associated with an increase in the number of red cells is shown in a report by Ledingham (*Transact. Path. Soc. of London*, 1906, Vol. LVII., p. 122 (Chart II.)), who treated a case of spleno-medullary leucocythæmia in this way. It is, however, possible to argue that this favourable result was due to the fact that destruction of leucocytes had occurred, and that this reduction made room for the presence of a more normal number of red cells.

A particularly difficult complication of leucocythæmia is priaprism. Weinerek (*Ref. Zentralbl. f. innere Med.*, 1907, No. 35, S. 875) describes the occurrence of this complication in a case of myelocytic leucocythæmia, and the results of the application of Roentgen-rays. Pain was immediately relieved, but the priaprism persisted, until, during the course of $5\frac{1}{2}$ weeks, there had been 17 applications of the treatment. The priaprism disappeared with a betterment of the blood conditions; impotence apparently ensued.

Finally, reference must be made to a *résumé* by Pancoast in the *University of Pennsylvania Med. Bulletin* (1907, Vol. XIX., No. 11, p. 282) of the experimental and practical application of Roentgen-rays in diseases of the blood, and blood-forming organs. Treatment by this means does not, he says,

appear to increase the mortality of these diseases, though sudden deaths have occurred during treatment. If the cases are not too advanced, improvement may be expected. Roentgen-rays are certainly of use in lymphadenoma, and cure may be expected in 3—4 years in a quarter of the cases, and, in almost all, a prolongation of life. Definite improvement was found in three out of five cases of pernicious anæmia.

In perusing the large number of references to the literature dealing with the therapeutic use of Roentgen-rays, it is pardonable if the reviewer expresses regret that so much energy should have been devoted to this branch of the study of this disease, whereas so comparatively little has been done in the pursuit of the less sensational, but infinitely more important, study of causation. The dictum of Launois and Weil, appended to their contribution to a study of pernicious anæmia (*Rev. de Med.*, 1904, No. 8, p. 617), should be read by those who, carried away by the prevailing fashion of applying Roentgen-rays to all and sundry obscure pathological conditions—"en l'absence de notions étiologiques réeles, on comprend que l'intervention thérapeutique demeure près que constamment inefficace."

A REVIEW OF SOME RECENT WORK ON GOUT.

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THE subject of gout is so large that in the following only a few points have been selected to show the trend of present day opinion.

URATES, ETC.

The supposition that excess of uric acid is the cause of gout has now been practically abandoned. It is the opinion of the majority of writers, that urates are only by-products of an abnormality of metabolism depending on other causes. This alteration is of some specific nature, as the manifestations of gout point to our having to do with a very definite disease, well-marked off from other conditions. What this alteration is we do not know, but it is not so simple, as was once supposed, when urate theories held the field.

Brunton,[1] in discussing hepatic inadequacy, in relation to gout and other diseases, refers to there being both a carbohydrate and protein inadequacy, and mentions the work of Stockvis, who found that pounded liver would convert urates into urea. This was found to be a function of the liver, only during the period of digestion. It suggests the presence of some chemical substance, which is active only at these times, and it is easy to picture an absence, or diminution of it, causing faulty nitrogenous metabolism accompanied by increase of urate in the system.

The investigation of the oxydases of the body has also enlarged our conception of general metabolism, although, so far, there is nothing practical to report. Reference may be made to the work of Kastle and Amos,[2] of Czyhlarz and V. Fürth,[3] and of Fleischer.[4]

Since it has been proved by Tunnicliffe and Rosenheim[5] that quadriurates do not exist as definite chemical compounds, we are not so troubled as we used to be when three combinations of uric acid were assumed. We have now, in

discussing urates, only to consider the normal and the acid compounds.

The purin bases, xanthin, hypoxanthin, guanin, adenin, etc., have rather receded from the position of importance which they recently held. It was at one time thought that they might have a great deal to do with the pathology of gout. All we can say is that they have not justified the position given them. They are not nearly so harmful to gouty patients, as was once supposed, and the taking of purin free diet is now considered for the average patient to be not only unnecessary, but inadvisable. Of course, a large quantity of purin containing diet is liable to upset the already deranged metabolism of the liver and rest of the system.

Although urates are not the cause of gout, there is still some unexplained reason why they do not leave the system, as they do in other diseases, when there is an excess, for instance, in leukæmia and febrile conditions. The urate may be in some state, in which the kidneys cannot get hold of it to excrete. It has been suggested,[6] that, in health, uric acid exists in the blood, combined with a phosphorus compound, and that, in gout, it is the absence of this combination which gives rise to the difficulty in elimination. Hence the administration of thyminic acid, and allied substances, but I do not know that, in many cases, any marked result has followed their use. Von Noorden[7] says "it remains uncertain whether the retention (of urate) arises because the outlet is blocked, or because the uric acid is held fast by chemical affinities."

Leathes'[8] recent work confirms the view that there is an increased production of nitrogenous waste materials in fevers. Urea, uric acid, and creatinine are all increased, but, of these three, the uric acid shows the most marked alteration. Whether here it is due to increased production, or deficient destruction, we do not know. In gout it is very probable that the urates found in the system are due to deficient destruction, and perhaps altered combination, as had been already suggested.

Leathes[9] also finds that urate excretion, in a normal individual on a purin free diet, is most marked in the early waking hours, thus indicating variations in the formation of

urate during different parts of the day.

That the muscular system may have to do with the formation of purins has been rendered probable by the work of Burian,[10] and the presence of perverted metabolism here may explain the good results obtained by physical methods of treatment in irregular gouty conditions.

Although we look upon urates as only by-products in gout, their further investigation may teach us how to rid the system of a substance which tends to get deposited in various parts of the body. Also the further study of uric acid, and of creatinine, will increase our knowledge of the internal metabolism.

THE GASTRO-INTESTINAL SYSTEM.

In the last few years much attention has been given to the state of the alimentary canal in gout, and there have been many suggestions as to this being the seat of the primary changes in the metabolism. This view has been suggested by several writers, amongst whom may be mentioned Gore,[11] Minkowski,[12] Watson.[13] It is now accepted by the majority of observers, that it is more than probable that gastro-intestinal derangements result in the formation of toxins, which, acting chiefly on the liver, give rise to those changes in body metabolism which we recognise as gout. In some cases of marked alimentary gouty disturbance, Grube [14] found, contrary to the usual idea, that the hydrochloric acid of the gastric juice was, in most cases, absent or diminished, and that lactic acid was present in some.

It appears probable that there are two kinds of gastro-intestinal derangement to be met with in gouty persons, one of a more chronic nature, indicating the primary disturbances giving rise to the toxins, which cause gout; and the other, which shows itself as an acute attack, often of an alarming nature, taking the place of an acute articular inflammation. It is also probable that, in gouty patients, intestinal illness of a sudden nature may simulate appendicitis, and unless great care is exercised, an error in diagnosis may occur.

CHLORIDE OF SODIUM IN GOUT.

Recent discussions of this subject are chiefly founded on the work of Widal, and others, on the rôle of common salt in the general metabolism in health and disease.

There has been, and still is, a great deal of divergence of opinion[15] on the influence of this salt in gouty states, and the matter reminds us of the history of the various laboratory solvents for uric acid, which are so often recommended to us, but which very seldom act in the expected manner, when introduced into the system.

It is certain that spas, containing a notable quantity of chloride of sodium, have a deserved reputation for the treatment of gouty conditions, and yet, from theoretical considerations, it has been suggested that they ought to be harmful, on the assumption that, in gout, the kidneys are not functioning properly, and also that sodium chloride is liable to increase the tendency to the precipitation of biurate in the system.

With reference to the former point, it is an open question to what extent the kidneys are involved in the earlier stages of gout. It is quite probable that the retention of products, within the system, is due to new chemical compounds, with which the normal kidney is not fitted to deal.

In those cases, in which there is obviously disease of the kidney and heart, and especially when associated with œdema, theory and practice agree in condemning waters, which contain more than traces of sodium chloride.

In cases also, in which there is a tendency to acute attacks, or in which there is much urate in the system, waters containing sodium chloride are held to be contra-indicated.

But in the many cases, in which the goutiness is more of a chronic nature, and especially in the many forms of irregular gout, these waters are generally admitted to be very useful, and here the beneficial effects seem to be partly due to their action on the digestive organs and the liver.

PHYSICAL METHODS OF TREATMENT.

The treatment of chronic gouty condition, whether articular or affecting other parts of the body, has advanced very considerably in recent years. The use of drugs for these states, unless persisted in for some time, is usually disappointing.

Treatment, founded on the combination of massage, exercises, radiant heat, and electricity, will usually greatly improve one of these cases in three or four weeks.

Take, for example, a chronic case of gouty neuritis.[16] There

is no one drug which is really useful, while, with the above methods, we can always promise alleviation at the least, and improvement goes on for some time after the cessation of the treatment.

The results are better when undertaken at some spa, where the drinking of water and the necessary dieting can be supervised.

I am afraid that many of our English spas are not fitted up as well as they might be for physical treatment. It is only recently, and with a few, that any attempt has been made to supplement their resources with the "fango" or mud treatment,[20] as practised in Italy, Germany, and at Larvik, amongst other places, in Norway. The composition of the brine used to mix the mud is different at all the places where this treatment is used, and, to an observer of results, this seems to indicate that the chief therapeutic agent is the continued direct heat, and, to a certain extent, the counter-irritant effect.

As it is usually necessary to combine the various physical agents mentioned, for the simple reason that it is best for the relief of the ailment, it is often difficult to say what influence each factor has in the good result. It is seldom that two cases can be treated similarly, and it is hardly necessary to add, every case, when treated by physical methods, should be under the direct supervision of a medical man.

DIET.

The general tendency, to be noticed in recent articles [17], [18], [19], is the recommendation of a simple mixed diet for the average case. Also, it is now customary to modify the diet more to suit the individual digestion than to prescribe one which is free from this or that chemical element, as, for example, the quantity of purin. In average cases, meat is not contra-indicated, but the amount should be restricted to one meat meal in the day. It is usual also to consider the carbohydrate element of the food, and its effect on the liver, as of more importance than was formerly the case. Hence it is advisable to reduce the amount of carbohydrate, which is taken in the comparatively pure form, such as potatoes, rice, etc.

If we wish the digestion to proceed as normally as possible, and to avoid the absorption of imperfectly elaborated products, it is only rational to prevent the undue dilution of the gastric juice, hence liquids, during meals, should be restricted as much as possible.

Simple meals, limitation of carbohydrate, restriction of alcohol, and the drinking of non-alcoholic fluids between meals are the chief points to be remembered. Vegetarianism, fruitarianism, and even zomotherapy may suit a few, but they do not seriously concern us, when discussing the general conditions of a gouty diet.

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A CASE OF RETRO-PERITONEAL ENDOTHELIOMA SIMULATING MALIGNANT DISEASE OF THE PANCREAS.

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W. C., male, aged 50, admitted to the Bradford Royal Infirmary under Dr. Campbell, October 1, 1906.

For about four weeks patient had noticed that his abdomen was swelling. He had no pain until just over a fortnight before admission, when he began to vomit. The vomiting at first caused him great pain, but later he became much easier. The swelling of the abdomen went on increasing, and he had to take to bed a fortnight before admission on account of general weakness. The vomit consisted of almost unaltered food. His bowels, as a rule, were regular, but, for a few weeks before admission, were costive. On admission he was a fairly nourished man, not cachectic, but looked ill. There was no jaundice or enlargement of the axillary or supraclavicular glands. The temperature was 98, the pulse 108, and the respirations 30. The abdomen was considerably distended, with evident enlargement of the superficial veins, especially over the lumbar and inguinal regions. On percussion there was dulness in both flanks, and, on palpation, an indefinite tumour mass was felt in the epigastrium. The abdomen was tapped, and 31 ozs. of blood-stained serum drawn off. After tapping, a large tumour mass was felt, occupying the whole epigastric region, and extending downwards to ½ inch below the umbilicus. Latterly, on both sides, it extended to ½ inch outside the mammary lines. It felt hard and roughly granular, and could be felt to move slightly downwards on respiration. A distinct inverted V-shaped notch could be felt in the middle line. At the lower part the mass was adherent to the umbilicus, and the umbilicus itself felt hard and indurated, otherwise the abdominal wall moved freely over the tumour. On percussion, it was fairly resonant in front with complete dulness

in both flanks. On distending the stomach with CO_2, the patient at once complained of difficulty of respiration, and, within half a minute, vomited. The upper part of the tumour became more prominent, and moved slightly downwards. In the left inguinal region a second tumour, somewhat harder than the mass in the upper part of the abdomen, could be felt. It was about the size of a Tangerine orange, and had a very fair mobility. There was no tenderness on palpating the abdomen. The liver dulness, on the nipple line, began at the upper border of the sixth rib, and extended to the costal margin, where there was an interval of about $\frac{1}{2}$ inch of normal resonance, which then passed into the slightly-diminished resonance over the tumour. On the left side, in the nipple line, dulness began at the sixth rib. Per rectum. There was some ballooning of the rectum, but no growth felt. The heart and lungs were normal. The urine contained urates, but no albumen, and reduced Fehling's solution. On fermentation with yeast, the specific gravity was reduced by 4 degrees, and the urine no longer reduced Fehling's solution. On the day of admission the patient, about one hour after taking some milk, vomited. The vomit contained no free hydrochloric acid, and the total acidity was ·12 per cent. He continued to vomit many times a day. His main complaint was extreme prostration. His bowels moved several times after enemata, the motions being small in amount, very pale in colour, and consisting almost entirely of fatty acid crystals. During the last week the reaction for sugar disappeared from the urine. Patient became gradually weaker, and died on October 10. Post-mortem performed 36 hours after death. On opening the abdomen a large amount of deeply blood-stained fluid escaped. The parietal peritoneum throughout its whole extent, but especially posteriorly, was much thickened ($\frac{1}{8}$ inch). Its surface was quite smooth. On the anterior surface of the liver there was an adhesion, and, between the umbilicus and the omentum, there was a second dense adhesion. The round ligament of the liver was converted into a dense cord $\frac{1}{2}$ inch in diameter. The visceral peritoneum, except for a few slight adhesions, was normal. The great omentum, which hung down like a large apron, was one mass of nodular growths. It extended down to about $\frac{1}{2}$ inch below the umbilicus, and,

except for its colour, looked, so far as its surface was concerned, not unlike a bunch of raisins. The nodules were moderately hard in consistence, yellow on section, and ranged up to that of a hazel nut in size. The small intestine was coiled up in the centre of the abdomen with the visceral peritoneum adherent in places. The y-shaped space of the mesentery of the small gut was, in its whole extent, entirely filled with growth, forming slabs about 1 inch in thickness, which could be readily separated from each other. The small gut itself, except at one point where the omentum had become adherent, was entirely free. The mesentery of the large gut was in the same condition, that of the descending colon and sigmoid flexure standing out as a large nodular tumour about $2\frac{1}{2}$ inches in thickness with the normal gut on its surface. The Appendices epiploicæ were infiltrated with growth, and showed as a fringe of nodules varying up to that of a hazel nut in size. The transverse colon ran along the posterior surface of the omental growth. The mesentery of the cæcum was in a similar condition to that of the descending colon but to a less extent. On raising the lower border of the liver, the stomach, about 3 square inches in extent, was seen lying surrounded by growth with nodules peeping up above the lesser curvature. Its wall was quite normal, and in no part was it infiltrated with the growth. The liver and gall bladder, except for adhesions, were free from growth. The spleen was enlarged, and its cut surface showed several old infarcts. The kidneys and suprarenals were normal. The pancreas was dissected out from behind, and, except that it was smaller and flatter than usual, appeared normal. Running along its upper border, there was a hard, more or less circular, band of tissue about $2\frac{1}{2}$ inches in circumference, which could be largely separated with the finger from the surrounding tissues, especially posteriorly. The whole growth, which after the removal of all the organs weighed $10\frac{1}{2}$ lbs., was entirely confined to the abdominal cavity. The other organs were normal. Dr. Duncan, of the Aberdeen Pathological Department, kindly examined sections of the growth for me, and reported as follows :—"Sections of the growth immediately above the pancreas microscopically show bands of fibrous tissue extensively infiltrated with large cells of an endothelial character,

the cells being arranged in long rows or masses. With a higher power of the microscope, those endothelial cells show considerable variation in size and shape, being for the most part irregularly rounded with a faintly granular protoplasm. The nucleus, which is generally stained somewhat lightly, is rounded or oval, and shows fairly numerous chromatine granules. In some of the larger cells, the nucleus is of slightly irregular shape. Many of the deposits of tumour cells are surrounded by areas of leucocytic infiltration.

"*Sections of the Pancreas.*—Owing to marked post-mortem digestion, the exact condition of the pancreatic tissue proper cannot be made out, but it is evident that there is no infiltration by the growth.

"*Sections of the Omentum.*—The omentum shows numerous deposits of tumour cells similar in character to those described above. In many instances, the cells of these deposits are degenerated, and give no nuclear staining reaction. These dead areas are, as a rule, extensively infiltrated with polynuclear leucocytes. The capillaries of the omentum appear to be markedly engorged, and, in one or two places, small hæmorrhages can be seen.

"*Section of Peritoneum.*—The peritoneum is greatly thickened and shows numerous scattered deposits of tumour cells. There appears to be also a certain amount of proliferation of the fibrous tissue elements.

"*Sections of Spleen.*—The splenic infarcts present the usual microscopic features of this lesion. There are no tumour deposits in the spleen pulp. From the microscopic characters and distribution, the growth would appear to belong to the class of endotheliomata."

Remarks by Dr. Falconer.—The occurrence of marked pancreatic symptoms during life, in the presence of an apparently normal pancreas, may possibly have been the result of an impaired function of the pancreas from pressure by the mere weight of the tumour. Such cases[1] have been recorded in aneurysms, neoplasms, and degenerated lymph glands, in the neighbourhood. There was no evidence of local pressure on the pancreatic ducts. It was impossible to demonstrate, with certainty, the place of origin of the growth, but I think there are several points in favour of its having originated in

the retro-peritoneal tissues just above the pancreas. Here, there was a definite tumour mass running along the upper border of the pancreas, and it was in sections of this portion of the growth that the most characteristic parts of the tumour were found. Again, as the growth was confined to the retro-peritoneal tissues, and the parietal peritoneum, it is obvious that the condition could be most readily produced by a growth starting in the retro-peritoneal tissue about the root of the mesentery.

I am indebted to Dr. Campbell, Senior Physician to the Bradford Royal Infirmary, for permission to publish this case.

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OPEN METHOD OF ETHER ADMINISTRATION COMBINED WITH CHLOROFORM.

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During the last six months, I have employed the open method of administering ether, both in hospital and private practice, with excellent results. As I have not seen the routine I have employed described, it may be of interest especially to the general practitioner, to whose patients the smell of ether is often so much more obnoxious than that of chloroform. The apparatus consists of a Junker's inhaler with a flannel-covered mask, the mask, however, having a trough round the edge, in order to prevent any excess of the anæsthetic dripping on to the face, a 6-oz. bottle with an ordinary cork having two holes bored in the latter, through the larger of which passes a wick : and also a Schimmelbusch's flannel mask.

The anæsthesia is commenced by the usual administration of chloroform with the Junker, and as consciousness is being abolished, ether is dropped on gradually, alternating with the compression of the india-rubber ball of the Junker. By degrees, the ether is dropped on more and more rapidly, with the chloroform being administered less freely, until the patient is having simply ether. The anæsthesia is maintained by regular and constant dropping of ether on to the mask. In many cases, especially if the patient is an alcoholic, or very muscular and strong, there is a tendency for him to come out of the anæsthesia. This can be easily remedied by giving a few inhalations of chloroform by compressing the bulb of the Junker, the patient then having either chloroform, or a mixture of chloroform and ether, at the will of the administrator. When the patient is again thoroughly under, then ether can be resumed as before. The use of the Schimmelbusch's mask is that, in long anæsthesias, the mask occasionally gets a coating of frost on it, owing to the rapid evaporation of the ether, and it is handy to have a second mask by one to use

while the first is thawing.

The advantages, which I have found in the administration of ether by the open drop method, are :—

1. There is much less frequent vomiting after the operation.
2. The patient recovers from the anæsthesia within a very short time of the cessation of the administration.
3. The pulse, as a rule, is not only as good, but is frequently better, even after a prolonged operation than it was at the commencement.

Though personally I have not had the experience, a possible disadvantage may be that the cold, produced by the evaporation of the ether, may cause lung troubles, especially in patients predisposed to such conditions.

I have used ether by the open drop method from the beginning of the anæsthesia, but have found it not so satisfactory as the method described above, especially in alcoholics, and persons of a nervous excitable temperament, as it takes much longer to put them under, and the stage of excitement is very much prolonged.

I have employed this method with patients of every age, and have come to the conclusion that there is no advantage in using it with children, who take chloroform satisfactorily as a rule. So far as other patients are concerned, it can be used in every case, except in conditions of diseased lungs.

NOTES FROM FOREIGN JOURNALS.

MERCURIC BROMIDE IN SYPHILIS.

Dalimier finds, after several trials, that the best solution for use, as an intra-muscular injection in syphilis, is:—

℞. Hydrarg. Bromidi - - - - - - gr. viij.
Sodii Bromidi - - - - - gr. vj.
Aq. destill. steril. - - - - - - ʒj.
Misce. Fiat inject.

This injection is painless and effective in action.

(*Revue de Thérapeutique.*)

THE EARLY DIAGNOSIS OF CANCER OF THE STOMACH.

The only chance for a successful operation in cancer of the stomach, that is, one by which the new growth is removed, lies in early diagnosis of the affection. This is a matter of very considerable difficulty, as at this stage little more can be made out than dyspepsia, with loss of appetite and vomiting some time after a meal. Von Adler publishes in the *Wiener klin. Woch.* three tests, which are obtainable at an early stage of the disease —Salkovski's, Adler's, and Salomon's.

Salkovski tests the urine for albumose, after addition of a 5 per cent. solution of phosphoric acid and centrifugalising. It is not, however, at all to be relied upon, because, in 40 cases of cancer, a positive result was only obtained in about two-thirds, and the presence of albumose in the urine is not peculiar to cancer.

Adler's reaction is much more trustworthy, and consists in seeking for traces of blood in the fæces, after the patients have abstained from meat for a few days. The fæcal materials are diluted with a little water, to which have been added a few drops of glacial acetic acid. Into this mixture is poured a hot solution of benzidine in absolute alcohol, and the test is completed by adding a few drops of oxygen water. If blood is present, a blue-green colour appears. It is more sensitive than Weber's test with guaiacum, and is always to be found when a gastro-intestinal lesion bleeds slightly, thus proving the presence of an ulcer or a cancer.

Salomon's test, according to some German writers, provides a most valuable means of diagnosis. The stomach is washed out at night, until the solution is returned perfectly clear. The following morning no breakfast is given, but the lavage is repeated with the same solution, half a litre of normal saline. When this has been recovered from the stomach the amount of albumen contained is determined by Esbach's tube. If more than 20 m.g. per cent. are present, Salomon declares that cancer is present. Romano's investigations make the result appear much less positive, and he considers that every gastric retention, and every ulcer of the gastric mucous membrane can give a positive reaction. Taken singly, these tests are not conclusive. but, when all three are obtained, they afford strong presumptive evidence

of the presence of cancer, and certainly of ulcer.

Einhorn (*Deutsche medizinische Wochenschrift*) has simplified the benzidine test. Strips of paper are soaked in a saturated solution of benzidine in glacial acetic acid and dried. A piece of this paper, held with ivory forceps—for it must not be touched by the hand—is dipped into the solution suspected to contain blood. Over the paper is then poured a few drops of peroxide of hydrogen solution, and it is laid on a white porcelain plate. If blood is present, a green to blue colour appears in from a few seconds to a minute afterwards. The test is made even more exact and more certain by using an ether extract in place of the solution of the matter to be examined. It is as equally available for the contents of the stomach as for urine, and also for fæces, a pea-sized piece being rubbed up with 2 c.c. of water, and the reagent-paper dipped into this, the peroxide solution being poured over it immediately after removal.

THE TREATMENT OF NEPHRITIS.

The *Therapeutic Gazette*, for November, contains a symposium on nephritis, in which Professor Tyson deals with the question of treatment. As to measures of prevention, the immediate cause, in both parenchymatous and interstitial nephritis, is an irritant acting on the renal cells. The object of preventive treatment is to avert the irritant, while that of curative treatment is to subdue the irritant, and remove its remote results. There are many varieties of irritant, some of which are undiscoverable. Best known are the causes of the infectious diseases, over-eating and drinking, especially excess of proteid and alcohol, and to a less degree of tea and coffee. Others are the toxines, arising from intestinal putrefaction and fermentation, throwing excess of work on the renal cells, and ultimate damage, leading to imperfect elimination and retention of toxines, then degenerative changes in the vascular system and uræmia. The ingestion of strong tea and coffee, in large quantities, occurs more frequently among the lower classes than is commonly supposed. There is no doubt that exposure to cold and moisture, whether acting as a direct cause, of favouring the operation of other causes mentioned, is responsible for many cases. The treatment of acute nephritis is comparatively simple, absolute quiet, milk diet of poor rather than rich milk, purgatives, diaphoretics, and diluent diuretics are usually efficient for an average case. A judicious increase of the same measures will cope with uræmia and dropsy. Tyson is still timid of the use of morphia for the control of convulsions, though less so in those of parenchymatous than in interstitial inflammation, in which the danger is greater. Chloroform inhalation, a few drops on a handkerchief, is more efficient and safer, and the effect may be kept up by chloral enemas. Venesection is equally to be recommended, followed by injection of normal saline, hypodermoclysis or intravenous. Injection, without bleeding, may be dangerous, by overcharging the venous system. He emphasises this, and considers it wiser to make haste slowly in uræmic coma and convulsions.

The treatment of chronic cases requires a nicer judgment. Many are better with no more than a simple hygienic and dietetic course of a not too active kind. Such cases have usually been discovered by the life insurance examiner, and only need to be told to adopt certain pre-

cautions. He must avoid exposure, fatigue, and overwork, retire early, and get plenty of rest, and take a minimum of proteid food. There should be moderate eating of all kinds of food, and exclusion of alcoholic drinks; plenty of fluid should be taken between meals, but must not be overdone. Tyson has never joined in the red meat craze, and welcomes its decease. A daily warm bath at bedtime, followed by friction, is useful, but cold sea bathing is harmful. As no drug is yet known which will create new renal cells to replace those lapsed into connective tissue, the object of treatment must be to save the kidney from irritation. The tendency to anæmia calls for iron, which should be given in small doses. Tyson often gives the tincture of the chloride, in combination with very small doses of bichloride of mercury freely diluted. A regular action of the bowels also helps towards the checking of abnormal fermentation, with formation of toxines, in the stomach and intestines. Purgatives, which act on the liver, are especially serviceable in the same direction, for instance, a weekly or bi-weekly dose of calomel. Iodides are good diuretics in most cases, and may have some tendency to remove fibroid overgrowth. They are particularly useful in the later stage, when albumin and numerous casts are constantly present. The newer diuretics, such as aceto-theocin and diurethin, are useful.

In the uræmia of chronic nephritis, venesection with hypodermoclysis, purging and sweating are the sheet-anchors. Another valuable measure is the injection, high up in the colon, of hot salt solution at 110° F. For this, the hips must be raised, a rectal tube passed high up the rectum, and the water allowed to run in very slowly. If there is much œdema, Southey's tubes should be inserted. Nitro-glycerine is of great value in dealing with the high tension of granular kidney. Some increase of tension is necessary to proper function by a diseased kidney, but anything exceeding 160 m.m. Hg. is harmful. One-hundredth of grain of nitro-glycerine may be given as often as every two hours. In the opposite condition of low tension, digitalis and caffeine must be substituted. Cardiac failure, the result of dilatation, is another complication; strychnine, digitalis, or strophanthus are the best remedies. In such cases, the circulation must not be overloaded with water. Tyson gives Edebohl's decapsulation a place in treatment, but does not call it curative. It is applicable to parenchymatous nephritis, with extensive anasurea, which refuses to yield to other treatment. The relief comes through diminished tension. He looks upon organic treatment by fresh kidneys or thyroid as absurd.

The saddest picture is that of albuminuric retinitis. To avert it, there is nothing to add to his previous remarks; to lessen it, he tries mercurials and iodides to arrest the process, and puts the patient on the most stringent diet. All strain on the eyes must be avoided. He attaches great importance to an ophthalmoscopic examination in every case of Bright's disease at least twice a year. Renal headache has two forms; first, a more or less severe dull pain, often in the occipital region, lasting a variable time; secondly, a short sharp shooting pain, often the prelude to uræmic convulsions. As both are probably due to the causes of uræmia, the treatment is eliminative. He commends West's use of pilocarpine, beginning with a dose of one-twelfth of a grain, and rapidly increasing to get the effect on the skin. The headaches may require morphia, but before this is given

caffeine, nervous sedatives, and counter irritation should be tried.

HYPOPHYSIAL INADEQUACY.

Among the many different substances, recently utilised in opotherapy, hypophysial treatment is certainly one of the most unexpected, for the physiology of the hypophysis is hardly known. As a matter of fact, however, it appears that, in this direction, lies a therapeutic expedient of considerable value. Jean Azam has devoted his thesis at Paris to the subject, and the information gathered together therein, shows that much usefulness may accrue from this method. The part played by the hypophysis in the economy, although but little known, seems to have great importance. It appears to influence nutrition to a certain degree, as shown by the changes in it in acromegaly, and it is this function of which use has been made in infectious diseases by Louis Renon, and Arthur Delille. The results obtained by these observers, in 24 cases of grave infectious diseases, were recently communicated to the Société de thérapeutique. · In enteric fever, particularly, the therapeutic effect has been most evident, eight cases were treated and they all recovered. Six of the patients were not bathed, and among those must be noted two cases of of exceeding gravity. In one, myocarditis gave cause for a gloomy prognosis, and, in the other, a miscarriage occurred at the outset of her enteric disease, to be followed later by a puerperal infection, associated with her typhoid infection. In both these cases, the hypophysial treatment was followed by an almost simultaneous rise in the arterial tension, from 12 to 14 the tension rose by degrees to 20. The pulse, which, in several patients, was as high as 130 to 140 fell gradually to 90 and 84. The temperature, in both these cases, fell from one to two degrees, but went up again when the hypophysial treatment was stopped. Diuresis was well marked in all the patients; in some, the quantity of urine was 3 to 4 litre. In all the cases, convalescence was very quick. In all eight cases, the diagnosis of enteric was confirmed by the serum-test. In pneumonia, the effects were less favourable, but the cases were of extreme gravity. Pituitary gland substance was given in influenzal pulmonary congestion, cerebro-spinal meningitis, etc. In all, there were 4 deaths in the 24 cases. The daily dose given was ·3 to ·4 g. of the powdered hypophysis of bullock. At the end of his thesis, Azam gives a *résumé* of the effects of hypophysial inadequacy, and the influence of hypophysial opotherapy.

Inadequacy is characterised in toxi-infectious diseases, by (1) a fall in arterial tension, (2) quickening of the pulse. To these two principal symptoms are added secondary effects, including insomnia, loss of appetite, frequent sweat, and painful heat flushes.

Under the influence of hypophysial opotherapy in toxi-infections, are to be noted: (1) increase of arterial tension, (2) decrease in the rate of the pulse with increase in the force and amplitude of the beats, (3) increased diuresis, (4) increase of weight, (5) suppression of the secondary symptoms of hypophysial inadequacy, (6) a favourable influence on convalescence.

It is conceivable that this form of opotherapy will be able to rank beside specific treatment of toxi-infections, when the quickness of the pulse and the low tension suggest a functional insufficiency, or an actual lesion of the hypophysis.

(*Journal de Médecine et de Chirurgie pratiques.*)

Reviews of Books.

Cancer of the Womb; Its Symptoms, Diagnosis, Prognosis, and Treatment. By F. J. McCann, M.D., F.R.C.S., Physician to the Samaritan Hospital, London. London: Oxford University Press. 20s. net.

For many years, the author has been collecting the material to enable him to write a book on cancer of the womb, and this material he has used to excellent advantage, as shown in the work before us. He uses the word cancer in a comprehensive sense, so as to include carcinoma, sarcoma, and deciduoma malignum, so that we have a complete treatise on malignant disease of the uterus. The descriptions are systematic and concise, and appeal particularly to the general practitioner, for whom the book is specially intended. The chapters on diagnosis and differential diagnosis are very good, for the author is fully alive to the paramount importance of early diagnosis. At present, as he reminds us, operation in the early stages of the disease can cure uterine cancer, and the percentage of cures is destined to increase when medical practitioners are fully cognisant of the signs and symptoms, which cancer produces in its initial stages, and when surgical treatment is promptly employed. The surgical treatment of uterine cancer is well described, and its value appreciated at its true worth, and two specially good chapters are devoted to the treatment of inoperable uterine cancer, and to the after-treatment of operations for cancer of the womb. The outstanding feature of the work is the wealth and beauty of the illustrations which have been reproduced from photographs of both macroscopic and microscopic specimens, and accurately portray the appearance of the actual disease. Dr. McCann has produced a valuable work which deserves to be widely known.

Eye Injuries and their Treatment. By A. Maitland Ramsay, M.D., Ophthalmic Surgeon, Glasgow Royal Infirmary, Professor of Ophthalmology, St. Mungo's College. Lecturer on Eye Diseases, Queen Margaret College, University of Glasgow. Pp. 210; plates 25. Glasgow: James Maclehose & Sons. 18s. net.

Professor Ramsay is to be heartily congratulated upon the excellence of this volume, which is based upon a series of lectures delivered from time to time, in connection with post-graduate courses. The scope of the work is purely clinical, and based upon the personal experience of the author. We commend the book to all those who, in their practice, are likely to be called upon to face surgical emergencies in connection with eye injuries. The plates are, without exception, excellent. At the end of the book there is a very useful chapter on ocular therapeutics, and also a number of formulæ, which are in use at the Glasgow Ophthalmic Institution, and which include both local applications and constitutional remedies. After the general index, there is added an index to Pharmacopœia, which

considerably increases the value of the work.

Diseases of the Eye. By J. Herbert Parsons, D.Sc., M.B., B.S., F.R.C.S., Assistant Ophthalmic Surgeon, University College Hospital; Assistant Surgeon, Royal London Ophthalmic Hospital; Ophthalmic Surgeon, Hospital for Sick Children, Great Ormond Street, etc. Pp. 664. London: J. & A. Churchill. 10s. 6d. net.

Mr. J. Herbert Parsons is to be congratulated upon the excellence of this manual, which he has written for students and practitioners. The work deals in a very practical manner with the commoner diseases of the eye; those with which the practitioner is most likely to meet. The portion which refers to treatment is excellent, for only the well-established methods are discussed and described, while those of questionable value have been wisely omitted. For senior medical students and general practitioners we consider the book to be an ideal one.

Ulceration of the Cornea. By Angus MacNab, B.A., B.Sc., M.B., Ch.B., F.R.C.S., Chief Clinical Assistant, Royal London Ophthalmic Hospital. Pp. 196. London: Bailliere, Tindall, & Cox. 5s. net.

This book gives a clear and complete account of the various ulcerative conditions of the cornea, and is mainly based upon the author's experience, which he has gained on the Continent. The volume is illustrated by twenty figures, of which many are excellent. Chapter ten gives a brief account of the various organisms, which are described in connection with corneal ulcers, and the last chapter contains an account of Professor Axenfeld's operation for excising the lacrymal sac.

Metabolism and Practical Medicine. By Carl Von Noorden, Professor of the First University Medical Clinic, Vienna. Vol. I., The Physiology of Metabolism. By Adolf Magnus-Levy. Vol. II., The Pathology of Metabolism, by Carl v. Noorden, Fr. Kraus, Ad. Schmidt, W. Weintraud, M. Matthes, and H. Strauss. English edition under the editorship of I. Walker Hall, Professor of Pathology, University College, Bristol, Pathologist to the Bristol Royal Infirmary. Vol. I., pp. 452; Vol. II., pp. 525. London: William Heinemann.

We congratulate the compilers of this book on having produced a translation of a work of such excellence as Von Noorden's *Handbuch der Pathologie des Stoffwechsels.* The translation at present to hand is divided into two volumes corresponding with the first part of the original. We hope that the translation of the second part will soon be through the press, as the whole will be of great value to those who find the reading of German laborious, and who wish to keep abreast of all that pertains to recent work on Metabolism. Vol. I. deals with the Physiology of Metabolism, the most important articles being on "Digestion and Absorption," "Fate of the Food Stuffs in the Tissues," "Metabolism in Man," and "Metabolism of Mineral Substances." The various articles are clearly and well treated, and, in debatable matters, the common-sense and broad-minded views of the author have been well translated. There is a complete bibliography at the end of each article, and the method of abbreviations adopted by the editor saves

much space. This list is of itself of value, with its references to the original investigations which have been discussed in the preceding article. In German works, one has often to complain of a certain amount of redundancy, but, in this book, the lucidity and the omission of unnecessary detail are quite refreshing.

Vol. II. deals with the pathology of Metabolism, and the diseases, treated of comprise, Hunger and Starvation, Overfeeding, Fever and Infection, Diseases of the Stomach and Intestine, Liver, Respiration and Circulation, Blood, and Kidneys.

Dr. Milroy has, perhaps, been responsible for more of the translation than any one of the others, but we must compliment them all, as well as the editor, on the excellence of the combined effort.

We can confidently recommend the book to all medical men, since its reading does not require any very advanced knowledge of physiology, and they will be well repaid for any time given to the perusal of the various articles. The whole work demonstrates how much our present-day knowledge of medicine owes to investigations in physiology.

Bacterial Infections of the Digestive Tract. By C. A. Herter, M.D., Professor of Pharmacology and Therapeutics in Columbia University, Consulting Physician to the City Hospital, New York. Pp. 360. London: Macmillan & Co. 6s. 6d.

This work will be very useful to those who wish to improve their acquaintance with a subject which is coming very much to the front. We are beginning to see more and more probabilities of the origin of disease in the gastro-intestinal tract. Variations of the intestinal flora, and changes in their chemical products so acting on the intestinal epithelium as to cause absorption of deleterious substances into the system, may account for more diseases than we even now suspect. Useful articles are given on the bacteria of the alimentary canal at different ages, on the influence of putrefactive changes on the onset of senility, the difference between the bacteria found in the intestines of carnivora and herbivora, and on many other interesting and important points. The influence of the mastication and the cooking of food are also discussed, and there is a very suggestive chapter on the action of bacterial products on the epithelial cells lining the digestive tract. On one point we must differ from the author (p. 98), as the resorptive function of the tubules of the kidney is not now usually accepted by physiologists. The methods of investigation are fully and well given, and examples of some common bacterial infections added. The chapters on the definite chemical products of the bacterial are useful, although they show how little we really know of this part of the subject. Without work on intestinal bacteria, we cannot advance very far in the control and cure of digestive conditions, and such work as is discussed in this book opens up for us wide possibilities in the future treatment of disease originating in the digestive tract.

Notes by the Way.

The Diminution of Tuberculosis.

Dr. Timbrell Bulstrode's report to the Local Government Board on various "aspects of the tuberculosis question" covers a vast amount of ground, and draws some conclusions not generally expected. The conclusion, however, that the white plague is gradually being stayed, gratifying as it is, can hardly be so described. Even if statistics had not been available, and medical observation did not count, one could have inferred the diminishing prevalence of the disease in real life from its diminishing prevalence in imaginative and biographical literature. The poetry and fiction of the beginning of the nineteenth century is sicklied o'er with the pale cast of consumption. The hectic sentiment of the "Queen of the May" is, perhaps, its most conspicuous manifestation; but it also abounds in the early-Victorian novel. To send the heroine into a "decline" is there the normal method of striking the note of pathos; and a study of the biographies of the same period shows how faithfully fiction, in this respect, echoed fact. One takes up Life after Life, and finds one promising career after another brought to a premature and melancholy termination by the mysterious and pathetic malady. The sad cases of Henry Kirke White, of John Sterling, of Richard Hurrell Froude are typically representative of an immense group of cases. They can be paralleled nowadays, of course, but the parallels are comparatively few; while, in fiction, the heroine who wastes away from consumption is almost as rare as her sister in early-Victorian romance whose tragedy was to lose her beauty from a disfiguring attack of small-pox.

* * * * *

The Use of Sanatoria.

What is really surprising in Dr. Bulstrode's Report is the statement that, though the mortality from tuberculosis has declined from 39·9 in every 10,000 persons living in 1838 to 11·5 per 10,000 in 1906, no special immediate improvement is traceable to any of the remedial or prophylactic measures taken, from the Public Health Act of 1875 to the inauguration of the

Sanatorium movement in 1899. The explanation must be that reforms, both in the way of preventive sanitation and of treatment, take time to become visibly operative in the case of a disease of which the period of incubation is long and the degree and conditions of communicability are not yet fully ascertained. In the case of sanatoria, Dr. Bulstrode finds the immediate results encouraging, but the after results, by comparison, disappointing. That, no doubt, was inevitable in view of the natural anxiety of patients to get back to work as soon as they felt better, instead of waiting until medical authority pronounced them well. In spite of this difficulty, however, Dr. Bulstrode says that "the statistics of many sanatoria appear to indicate not only that many patients have been restored to the ranks of the workers, but that some of them may remain in those ranks for several years, perhaps indefinitely." That fact alone would suffice to justify the Sanatorium movement; and it is not to be doubted that sanatoria exercise an indirect as well as a direct influence of great value, by educating the ignorant in the conditions of healthy living. That effect, it seems not over-sanguine to expect, will be reflected in the statistics before long, though it is early to look for evidence of it yet.

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Infection.

ANOTHER vexed question treated in the Report is the manner in which tuberculosis is "caught." That it is "catching" has been universally recognised since the discovery of the tubercle bacillus in 1882. The common view attributes its propagation to "infected air conveyed directly to the lungs during the act of respiration." Dr. Bulstrode inclines to the alternative opinion that, in the majority of cases, the patient either drinks or eats the bacillus, and that it is conveyed to the lungs, when it is the lungs that are attacked, "by way of the intestinal tract." The one hypothesis does not necessarily exclude the other; but the suggestion furnishes us with an additional reason for insisting upon more rigorous inspection of our milk and meat. There are large and powerful interests strenuously opposed to such inspection. The view of the milk vendors on the subject was conspicuously in evidence at the time of the last London County Council election; and the view of

the magnates of the Beef Trust is probably quite as strong. They are not selling beef, as the Americans say, "for their health." But it is their business to sell it for the health of the consumer, and there are many indications that they require careful supervision to keep them up to the mark in this respect.

* * * * *

Proprietary Medicaments.

More than one moral is pointed by the circumstances of the case in which our contemporary the *Lancet* was mulcted in damages. It proved, on the one hand, that there are limits to the latitude which a jury will allow to a professional journal in its comments on proprietary medicaments; but much of the evidence given also brought into clear relief the risks run by those who habitually use many of the most widely-advertised remedies. They are not all equally bad. Some of them, no doubt, are pretty much what the doctor would prescribe in some of the cases in which they are used. Some of them, in all likelihood, are taken from the British Pharmacopœia, or are prepared from the prescriptions of medical men. The doctor prescribes them, however, not for indiscriminate, but for individual use; and their utility depends, as Aristotle put it, on "the how and the when and the where." In medicine, not only is one man's meat another man's poison. The same man may find that the same drug is his meat in one set of circumstances, and his poison in another. This is especially the case with remedies containing such drugs as opium and cocaine. The average man knows nothing about cocaine except that it is a local anæsthetic used by dentists. He does not know what the dangers of the cocaine habit are, or how easily that habit may be acquired, or in what quantity the cocaine is present in certain advertised remedies, or even, in some cases, that it is present in them at all. Consequently he doctors himself at his peril—at the risk even, in extreme cases, of death. The matter is one on which practitioners might often find a useful opportunity of uttering a timely word of warning to their patients, not necessarily condemning all advertised remedies absolutely, but insisting upon the wisdom of consulting their medical adviser before indulging in these proprietary articles.

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Children and Free Meals.

THERE have been further attempts to induce the London County Council to apply the Provision of Meals Act and supply food, at the cost of the ratepayers, to school children who are not properly fed at home. The measure is a little difficult to criticise. Weighty reasons can be urged both for and against it; and the conflicting arguments proceed from such different starting points that it is by no means easy to balance them against each other and get at their comparative value. To feed the children is to take a further step on the road towards the pauperisation of the community and the destruction of the sense of parental obligation; and that is, on the face of it, an objectionable course. On the other hand, the health of the children, who are the helpless victims of irresponsible parents, is at stake. They are the citizens of the future; their efficiency as citizens will be conditioned by their health; their health will suffer if they are fed either insufficiently or improperly during the critical years of their growth. The problem is, therefore, how to do the best for the children without striking a blow at family life or relieving the parents of a burden which it is their duty to bear. It is not a problem which we will pretend to solve on the spur of the moment; but there are certainly two classes of children whom the ratepayer may fairly be asked to help. The first are the children whose parents, through misfortune, cannot do their duty to them; the second are those whose parents are so poor that, though they do their best, they cannot do enough. The problem becomes more embarrassing when we consider the case of the children of drunken or lazy parents who grossly neglect a duty which it is perfectly within their power to perform. In such cases, perhaps, the best course would be to alleviate the sufferings of the children, but concurrently to take proceedings against the parents for not discharging obligations for which they have made themselves responsible. The line between the different classes of cases will no doubt, in practice, be difficult to draw; but it need not be impossible. The question, at any rate, is one which we shall have to face in the immediate future; and it is as well that we should all try

to think out the difficulties involved in it before the movement now being set on foot becomes too strong to be checked or modified.

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Literary Clinics.

An interesting problem in literary clinics is discussed in Mr. Francis Gribble's new book *George Sand and her Lovers*. What was the nature of the illness through which the novelist nursed Alfred de Musset when she was living with him at Venice? Dr. Pagello, who, while attending the patient, supplanted him in the affections of his mistress, writes: "I diagnosed a nervous typhoid fever." That of course is nonsense. Nervous typhoid fever is a complication unknown to medicine, and typhoid fever itself was unknown to medicine in the year 1834. Typhoid and typhus were at that date confused and called "continued fever." It follows that the alleged diagnosis was really an afterthought; and the record of the symptoms indicates that the afterthought was due, not to increased pathological knowledge but to a desire to protect the poet's reputation by tampering with the truth. "When," as Mr. Gribble writes, "we find the delirious patient seeing 'phantoms' round his bed, needing to be held down by two strong men, warned by his doctor during his convalescence to avoid strong drink, suspected of obtaining it surreptitiously, and relapsing, we know pretty well what to think." What we feel compelled to think is, of course, that the disorder from which Musset was suffering was delirium tremens. We feel as certain of that as it is possible to be of the malady of any patient whom we have not actually had under observation. The fact—a "new fact" in literary history—may perhaps in some measure explain the facility with which George Sand transferred her affections from the sufferer to his medical attendant, though it certainly cannot be said that it makes Pagello's conduct in kissing her behind the screen, as Musset averred that she did, any the more excusable from the point of view either of morality or of professional etiquette.

Practical Notes.

The Suprarenal Bodies.—Formerly there was an idea that these ductless glands were just fœtal relics, and this view arose from the comparatively large size to which they attain in the fœtus, for, at the third month of intra-uterine life, the kidneys and suprarenal capsules are about the same size. At the sixth month, however, the kidneys are just twice the size of the suprarenal capsules. It was Brown-Séquard who first removed these glands in animals, and showed that their presence was absolutely essential to life. The development of the capsules shows that they have a twofold origin, the cortical portion arises from the epithelium of the cœlom in the Wolffian ridge, while the medullary part develops in connection with the ganglion cells of the symphathetic system. Comparative anatomy, too, shows this separate origin of the two portions of the glands. In the Elasmobranch fishes, the cortical parts form the single inter-renal body, while the medullary portions form the paired bodies, situated just above the kidneys. Microscopically, the cortical part of the mammalian suprarenal body is seen to be mainly cellular, the cells being variously arranged, whereas the medullary part, which is very vascular, contains large irregular branched cells with pigment granules, nerve cells, and nerve fibres. The suprarenal vein, which commences in the medullary part of the gland, is surrounded by a large amount of plain muscle, the function of which is probably to regulate the circulation of blood through the organ. Brown-Séquard showed that the complete removal of the suprarenal glands in guinea-pigs, dogs, cats, rats, etc., caused their death in from nine to fourteen hours, the chief symptoms being loss of appetite, general muscular and cardiac weakness, and convulsions. If one gland alone is removed, the other hypertrophies, and the animal seems none the worse for the operation. The question then arises, whether the animals die from loss of a definite secretion, or from the accumulation of a toxic substance, or substances, which would normally be rendered inert by the activity of the gland. It was Oliver and Schäfer, who showed that extracts,

prepared from the *medullary* portion of the gland, produce a marked contraction of the arterioles of the body generally, and consequently a rise of arterial blood-pressure. This action is a peripheral one, for the contraction of the muscle of the arterioles occurs equally well after section of the spinal cord, and after division of the nerves to the limbs. This active principle is not destroyed on artificial gastric digestion, or by boiling, and it has a powerful styptic action in readily checking hæmorrhage from small blood vessels.

Cases have been recorded of extraordinary precocity of sexual development in children, associated with hypertrophy of the suprarenal capsules. Atrophy is associated with non-development of the pubic hair and genital organs. It is presumed, therefore, that the cortical portion of the gland is probably connected with the growth of the body and the development of puberty and sexual maturity.

ADRENALIN.—The active principle from the medulla of the suprarenal capsule is now generally known as *adrenalin*, though other terms have been applied, such as suprarenin, epinephrin. It is prepared as a white, light, crystalline powder, possessing a bitter taste, and is found to be quite stable in the dry form. It is sparingly soluble in water, and in watery solution becomes red, and eventually brown. It readily forms salts, and a watery solution of the chloride, of a strength 1 in 10,000, will blanch the normal conjunctiva in one minute. Langley has shown that the effects produced by adrenalin upon any tissue are such as follow excitation of the sympathetic nerve which supplies that tissue. Brodie and Dixon found that adrenalin has no action upon the pulmonary arterioles. Now the pulmonary arterioles are not supplied with vasoconstrictor nerves, and this shows that the action of the adrenalin is rather upon the nerve endings of the sympathetics than directly upon the plain muscle of the blood-vessel walls. It is a significant fact that the adrenalin, which is derived from the medullary part of the gland, which part is developed from the sympathetic system, acts only upon the sympathetic nerve terminals. This valuable drug, used so extensively, and with such benefit to the patient, in medical, surgical, gynæcological, and special practice, was discovered

in a purely scientific research, which involved the vivisection of animals. It has its limitations, however, and, as Brodie and Dixon have shown as the result of their instructive researches, is quite *useless* in cases of hæmoptysis, for the reasons already mentioned.

Addison's Disease.—The conditions of the suprarenal gland, found in Addison's disease, are described by Rolleston as follows:—"1. A fibro-caseous lesion due to tuberculosis —*far the commonest condition found.* 2. Simple atrophy. 3. Chronic interstitial inflammation leading to atrophy. 4. Malignant disease invading the capsules, including Addison's case of malignant nodule compressing the suprarenal vein. 5. Blood extravasated into the suprarenal bodies. 6. No lesion of the suprarenal bodies themselves, but pressure or inflammation involving the semilunar ganglia. The first is the only common cause of Addison's disease. The others, with the exception of simple atrophy, may be considered as very rare."

Typhoid Infection.—Infection with the typhoid bacillus, as is well known, is the real cause of enteric fever. Ingestion of the bacillus in infected water is the usual mode of infection, hence typhoid fever is usually looked upon as one of the great water-borne diseases. The infection of water is usually due to contamination with sewage, which may at any time contain the typhoid bacillus. By contact with infected water, other articles of diet, such as milk, oysters, and other shell fish, and raw uncooked vegetables, such as watercress, lettuce, or celery, may themselves become contaminated, and contain the specific micro-organism. Foodstuffs may also be contaminated by dust which contains the typhoid bacillus. Flies may also mechanically carry these and other germs, and so infect food supplies, as was the case in South Africa during the late war, where flies were very numerous, and divided their time between the latrines and the cook-house. Lastly, infection may result from contamination with the bed-linen, which has been soiled by the discharges of typhoid fever

patients. It is in this way that the attendants on typhoid fever patients usually become infected.

Typhoid Carriers.—Notwithstanding our knowledge of the ætiology of typhoid fever, the source of infection in many sporadic cases, and in some epidemics of this disease, is extremely puzzling. Much light has now been shed on such cases by bacteriological science, in the discovery of "typhoid carriers," a subject which is now receiving much attention at the hands of German and American bacteriologists, whilst Drs. A. and J. C. G. Ledingham have also studied the question in this country. A typhoid carrier is a person who, whilst exhibiting no signs of illness, passes typhoid bacilli in the stools. The dangers of such persons to the community, and the possibility that they may at any time provide the material for an outbreak of typhoid fever, are obvious. Such cases also explain the hitherto unrecognised source of infection in many outbreaks of the disease.

Typhoid carriers may be either acute or chronic. "Acute typhoid carriers" are temporary harbourers of the bacillus, who do not harbour it more than a few weeks after recovery from the disease. Further, without suffering themselves, those who have been closely associated with typhoid patients may for a time pass typhoid bacilli in the same way, and must also be included in this class.

"Chronic typhoid carriers" harbour the bacillus for a prolonged period after complete recovery from the disease, and may scatter the bacilli for an almost indefinite period. Thus several epidemics in a household were traced to a woman, who, 30 years previously, had suffered from typhoid fever complicated with jaundice. The famous Strassburg baker, described by Kayser in 1906, is the classical example of chronic typhoid carriers. She owned a bakery in Strassburg, in which every new employee, sooner or later, fell a victim to typhoid fever, of which two died. The baker herself had had typhoid fever 10 years previously, and her fæces were found to contain typhoid bacilli in large numbers, whilst her serum gave a positive Widal reaction, agglutinating typhoid bacilli in dilutions of 1 in 100. The same observer discovered another carrier, in the case of a woman engaged in the milk trade,

the milk becoming infected, and causing 17 cases, with two deaths.

A considerable number of the recorded cases have occurred in lunatic asylums, in which, from the filthy habits of some of the patients, typhoid carriers would be particularly dangerous. The Ledinghams have worked with material from this source, and have succeeded in isolating three typhoid carriers out of a total of 90 females examined.

The most probable explanation of typhoid carriers would seem to be that the bacilli vegetate in the gall-bladder, from which they are intermittently ejected into the intestine, and so passed in the stools.

It is clear that any person, who is found to be a typhoid carrier, should be kept under bacteriological supervision. Further, many epidemics would probably be avoided, if the excreta of recovered typhoid cases, especially in the case of women, were systematically examined for typhoid bacilli for a prolonged period, say, six months, after recovery from the disease.

Post-typhoid Suppuration.—It has now been definitely established that the typhoid bacillus is capable of producing suppuration, apart from the presence of other pus-producing organisms, and that the suppurative lesion may occur either as a complication, or as a sequel to the attack of fever. The commonest situations, in which this may occur, are the gall-bladder, in which infection results by direct extension of the infection from the intestinal mucosa, or as a suppurative periostitis, in certain long bones, notably the tibia and the ribs, in which the infective agent is carried in the blood-stream. Other situations, in which post-typhoid suppuration has been known to exist, are the lungs, lymph glands, diaphragm, testis, and salivary glands.

Cases of post-typhoid suppuration, in two of these rarer situations, have recently been recorded in England, namely, in the thyroid gland, and in an ovarian cyst. The former was recorded in the *Lancet* by Dr. Melandri and Mr. Legg, and was the case of an Italian, aged 26, in whom an acute suppuration occurred in a thyroid adenoma in the sixth week of a febrile illness, which was not definitely diagnosed as typhoid fever.

Nevertheless typhoid bacilli were obtained in pure culture from the pus, and gave a positive Widal's reaction with dilutions of 1 in 50. Roger, of Montpellier, records a case, in which inflammatory symptoms occurred in the thyroid leading to suppuration in the early convalescence of typhoid fever. Here, again, bacteriological examination revealed the presence of typhoid bacilli. He also collected 20 cases (including his own), in 19 of which the typhoid bacillus was found, alone in 15 cases, and along with other organisms in 4.

Infection of an ovarian cyst with the typhoid bacillus must necessarily be of rare occurrence, since it connotes the occurrence of typhoid fever in a patient already possessing an ovarian cyst, yet such a case was recently recorded by Taylor in the *Journal of Obstetrics and Gynæcology of the British Empire*, and the author has collected 11 other cases of post-typhoid suppuration in ovarian cysts, from which the typhoid bacillus was recovered. The case described was that of a widow, aged 37, who had had typhoid fever in India twelve months before the performance of ovariotomy, febrile symptoms having been absent in the meantime. Nevertheless, the extirpated cyst (the presence of which had been known since convalescence from the fever) was found to contain pus from which the typhoid bacillus was the only organism obtained. A positive Widal's reaction was also obtained with the patient's serum. The author considers that infective micro-organisms were carried to the cyst by the blood-stream during the febrile period of the disease, and had vegetated in the cyst until it produced suppuration, and operation was undertaken. He divides post-typhoid suppuration into three varieties, namely :—

(1) A mixed infection where both pyogenetic cocci and typhoid bacilli are present.

(2) A secondary infection, caused by invasion of pyogenetic cocci into an organ, whose resisting power has been lessened as the result of typhoid fever.

(3) A pure infection by the typhoid bacillus alone.

Preparations and Inventions.

"Elixoid" Pine Tar Compound.

(Messrs. Burroughs Wellcome & Co., Snow Hill Buildings, London, E.C.)

This is a pleasantly flavoured fluid preparation containing pinol, tar, terpin hydrate, virginian prune, balsam of Tolu, and ipecacuanha. As may be readily conjectured, this combination is very effective in the treatment of affections of the respiratory organs. It allays pulmonary irritation, and is especially useful in cases of chronic bronchitis and bronchorrhœa. It soothes and relieves coughs, and may be used in those cases in which preparations of opium are contra-indicated. From one-half to two fluid drachms after meals may be given, or smaller doses more frequently. It is issued in four-ounce bottles.

Tabloids.

(Messrs. Burroughs Wellcome & Co., Snow Hill Buildings, London, E.C.)

'Tabloid' Capsule Sandal Wood Oil.—The various discomforts, such as the nauseous taste of fluid preparations, eructation, pain in the back, etc., which follow the administration of impure sandal wood oil, are entirely prevented by the use of this capsule, which contains only the pure oil. Each capsule contains min. 5 (·296 c.c.)

'Tabloid' Capsule Terebene.—In the treatment of chronic bronchitis, catarrh, and other pulmonary conditions, the value of terebene is well recognised. These capsules provide an agreeable and very effective means of administering accurate doses of pure terebene. Each contains min. 5 (·296 c.c.) These 'Tabloid' capsules are issued to the profession in exceedingly neat tin boxes, on which full directions are printed.

'Tabloid' "Gingamint."—(Soda mint compound).—This is a new and improved form of the well-known soda-mint tabloid, and is a very valuable antacid and stomachic for the relief of dyspepsia, nausea, heartburn, and flatulence. Each 'tabloid'

contains sodium bicarbonate, gr. 5; ammonium bicarbonate, gr. $\frac{1}{12}$; also gingerine, saccharine, and oil of peppermint.

'Tabloid' "Gingamint" is issued in bottles of 25 and 100.

SPECIALITIES.

(Messrs. Parke, Davis & Co., Beak Street, Regent Street, London, W.)

Petroleum Emulsion.—As a rule, the liquid paraffin of commerce is quite unfit for medicinal purposes, but in the Petroleum Emulsion put on the market by Messrs. Parke, Davis & Co. we find a pure compound. Suitable amounts of the hypophosphites of calcium and sodium are present in the preparation. It is supplied in bottles containing either 8 or 16 fluid ounces.

Adrenalin and Chloretone Ointment.—This ointment contains adrenalin 1 part and chloretone 50 parts in each 1,000 parts, thus forming an extremely useful ointment, which has astringent, analgesic, and antiseptic properties. It is particularly valuable in such troublesome conditions as hæmorrhoids, pruritus ani, pruritus vulvæ, and chronic eczema. It is supplied in a special kind of *collapsible tube*, which affords a very ready method of application.

Black Wash Tablets.—It is well known what an extremely useful application black wash is for superficial syphilitic sores. These tablets will therefore be found to be a great boon to medical officers of expeditions whose drug accommodation must of necessity be very limited. The tablets contain the constituents of the official Lotio Hydrargyri Nigra, and are supplied in bottles of 25.

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THE PRACTITIONER.

APRIL, 1908.

THE TREATMENT OF ACUTE PNEUMONIA.[1]

By SAMUEL WEST, M.D., F.R.C.P.,

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By pneumonia must be understood in this discussion the acute inflammation of the lung excited by the pneumococcus.

A few facts about the pneumococcus have an interesting bearing in relation to treatment.

The pneumococcus cannot survive long outside the body. An hour or two or less suffices to destroy it, though, in favourable circumstances, *e.g.*, in sputum kept moist and warm, it may live and retain its virulence for a fortnight. If it is so easily destroyed the wonder is where the supply comes from, for it seems to be a ubiquitous germ, and is very often found in a virulent form in the mouth and saliva of healthy persons.

Pneumonia, though a germ disease, is not infectious, that is, it does not spread from the sick to the healthy. Epidemic and house, or room, pneumonia has been described, but for the most part in pre-bacterial days, and much remains to be learnt about it. Our knowledge then of the natural history of the germ, and of its mode of propagation is defective.

Pneumonia is said to be increasing in frequency and fatality. Figures seem to prove this in America, but I do not think it true for this country. Cases of pneumonia are at times unusually frequent, as they are just now, but I have always supposed that this was explained by an outbreak of influenza, and for that reason the statistics, I quote in my book, are taken from periods before 1890, when influenza made its appearance here. To test this opinion, I took the figures of the Registrar-General for pneumonia and influenza since 1890, and the mortality curve for the two diseases is strikingly similar (*see* p. 430). So that I think the conclusion justified that

[1] The introduction to a discussion on the subject at the Harveian Society on March 5, 1908. Mr. D'Arcy Power, M.A., M.B., F.R.C.S., in the chair.

the fluctuation in pneumonia is entirely explained by the outbreak of influenza.

Fig. 1.—*Table showing mortality curve of Pneumonia and Influenza for the years* 1889-1905, *constructed from the Registrar-General's returns.*

------- *Influenza.* ——— *Pneumonia.*

Pneumonia being a germ disease, the questions in respect of treatment which arise are :—

1. How can the germs be destroyed, or their access to the body prevented, or failing this, how can the body be protected against them ? (*Prophylactic and Preventive.)*

2. If the germs have gained entrance into the body, how can they be destroyed there (*anti-bacterial*), or their effects neutralised (*anti-toxic*) ?

3. How can the symptoms which arise in the course of the disease be dealt with (*symptomatic*) ?

1. *Prophylactic and Preventive.*—We know so little of the conditions which determine an attack of pneumonia that we cannot do very much to prevent it.

Prophylactic.—Virulent pneumococci are so often present in the saliva, it follows that healthy persons must have considerable powers of resistance. But the resistance may be reduced in many ways. For instance, by exposure to cold, by the failure

of health consequent on illness or accident, and by specific diseases, especially measles and influenza. The risk is greatest where two or more of these predisposing causes are associated. Thus no influenza patient should be allowed to run the risk of chill and over-fatigue till the post-febrile depression stage is past. During this stage, the temperature is constantly subnormal, and thus becomes a clinical index of value. With measles, the risk is during the febrile stage, especially of the illness or soon after. No doubt the infection in this and other specific fevers is from the mouth, and nothing is more likely to diminish this risk than a careful mouth-toilet, and thus the cleansing and disinfection of the mouth are not only good nursing but good doctoring. Lastly, the toxines of the pneumococcus have a long, lasting and injurious effect upon the body, by permanently lowering its resistance, and rendering those who have had one attack not less but more liable to another.

Anti-bacterial and Anti-toxic treatment is directed to destroy, or check the development of the pneumococci, to increase the powers of resistance of the body to the germs, or to neutralise their effects. We have no means at present by which the germ can be destroyed or checked. The disease runs its own course, and nothing so far is known which will cut it short. Subcutaneous injections of quinine or of camphor in sterilised oil have been suggested, but their anti-bacterial action is not established. There is no serum or vaccine which can be relied on. There may be different strains of pneumococcus, at any rate it seems that the only serviceable vaccine is one derived from the patient's own pneumococcus, but, as this takes 14 days or so to prepare, the patient will be dead or well before his own vaccine is ready. If this vaccine is to be useful, it must then be for the empyemata or other complications which may follow. With so acute a disease as pneumonia, the serum or vaccine must be ready for use at once, and though we have nothing of the kind at present, with the example of diphtheria before us, it is not too much to hope that before long we shall have some anti-toxic method applicable to pneumonia.

Symptomatic.—The third method of treatment is to watch the symptoms as they arise, and modify and control them as seems necessary. The study of the natural history of pneumonia shows that it is a disease which, in the healthy and

young, tends to get well of itself. This has led to what is called the *expectant* method of treatment, as opposed to the more active virulent measures formerly in vogue. We now assist nature to throw off the disease, rather than lay heavy hands on what was thought to be the disease itself, lest by that means we do a fatal violence to the patient. Symptomatic treatment implies that, for a mild case of pneumonia, in a young and healthy person, where no symptoms are in excess, little special treatment is required, and that such treatment only becomes necessary where the symptoms are severe or out of the common.

GENERAL TREATMENT OF A MILD UNCOMPLICATED CASE.

The patient will, of course, be in bed, for he has rarely either inclination or power to leave it. The room should be kept cool and fresh, at a temperature not above 60° F. The windows may even be open, for fresh air does nothing but good, provided the patient is not in a draught. Actual open-air treatment has been advocated, but though it may be possible in a hospital to place the patient at once in the open air, it is impracticable under the conditions in which pneumonia develops in private practice. The patient should not be too warmly clothed or covered up. A rough blanket may be quite sufficient covering.

The diet should consist chiefly of milk and beef-tea, with which one or two eggs may be beaten up. Two or three pints of milk and two eggs in the 24 hours are ample for an adult. It is important to bear in mind that harm may be done by giving more milk than can be completely digested. The fever causes a craving for fluid, and milk is often given in quantities too large to be properly digested; it then lies in the stomach and undergoes fermentation, producing much discomfort, and even troublesome vomiting or diarrhœa. It is best where the thirst is extreme either to dilute the milk with some effervescing water, or, if sufficient food is taken, to slake the thirst with water acidulated with lemon-juice or with phosphoric acid. A prejudice seems to exist against giving water in fevers, for which there is no good reason. Stimulants are in ordinary cases unnecessary. The usual indications for their administration are given by the pulse and heart. A simple purge is generally required at the commencement, and nothing is better than a dose of castor oil, or a pill of calomel and

colocynth. If the skin is hot and dry, a diaphoretic mixture will do good, and in children a hot bath often gives great relief. Where a diaphoretic mixture is not indicated, an acid draught with some quinine or strychnine will help to clean the tongue and improve the appetite. Expectorants are unnecessary, and, if active, are injurious, for they have no effect upon the consolidated parts, and the last thing to be desired is to cause secretion into the air-tubes of the rest of the lungs. The pain in the side, if not relieved by counter-irritation or hot poultices, will be quickly relieved by a few leeches.

As soon as the fever is past, and the appetite returns, solid food may be given and a tonic administered.

When convalescence is established, care is still necessary. It is a good rule not to allow the patient to leave the bed until the temperature has been normal for at least 10 days. The heart has been heavily taxed during the attack, and requires time to recover itself. Premature getting up easily causes dilatation.

Next, the pleura has been generally involved during the attack, and mischief may continue and develop during convalescence often quite insidiously. Thus pus has been found in one or both pleura, and even the pericardium too, without any symptoms to suggest it. Such cases have been even known to die quite suddenly during an apparently perfectly normal convalescence. Therefore it should be made an invariable rule to examine, as a matter of routine, the pleura and pericardium regularly, even when the convalescence appears to be running a normal course. Again, the nutrition of the lung in general has been profoundly affected, so that there is a tendency to catch cold on slight exposure, and a liability of bronchitis may easily develop, if care is not taken. Even emphysema may be sometimes traced quite clearly to an attack of pneumonia.

For all these reasons, care is necessary during convalescence and for some time after, but with care recovery is usually complete.

SPECIAL TREATMENT, THAT IS, THE TREATMENT OF SPECIAL SYMPTOMS.

Fever.—There is a relation between the temperature, pulse, and respiration in pneumonia which may be regarded as the normal for the disease. Thus, with a temperature of 103°, the

pulse should be 120 and the respiration 40, and departure from this normal, whether above or below, should be noted carefully and watched. A temperature of 103° for the few days a pneumonia lasts will do but little harm of itself, and need not be treated. There are two classes of cases in which the temperature will call for treatment; in the one it runs up suddenly to a considerable height (hyperpyrexia), and in the other it continues at a high general level without much remission throughout the 24 hours.

Hyperpyrexia, in the strict sense, is even rarer in pneumonia than it is in rheumatic fever, but it is still more dangerous. It requires the immediate use of the cold bath, if there is to be any chance of saving life. Cold baths have been used as a routine treatment even in ordinary cases with a temperature which cannot be called abnormally high. Patients have been plunged into water almost at a freezing temperature many times each day, as long as the fever lasted, and that without the bad effects which might have been anticipated. The bath, as ordinarily administered to the adult, is attended with a good deal of fatigue, and, since the result desired can be attained in other ways, *e.g.*, by sponging, cradling, or packing, the cold bath is reserved for exceptional cases.

Cradling is the simplest in practice, and is certainly very efficacious. The patient is stripped, or, at any rate, covered only with a light sheet or night-dress; a cradle is put over extending from the chin to the feet, and over this is laid a single sheet, and, if necessary, ice-bags may be hung inside. In this way the temperature may be considerably lowered and kept down.

Wet packing is useful when the skin is dry and pungently hot.

A hot bath is for children better still at a temperature of 105° to 108°, a few handfuls of mustard being mixed with the water. After being removed from the bath, the patient is laid, without being dried, between blankets; a powerful reaction soon sets in with profuse sweating, and continues for some hours, during which time the child, who has been restless before, often sleeps quietly and wakes up much refreshed. I have given such a bath to children daily in the evening, or even twice in the day, and always with the greatest benefit.

Antipyretic drugs have two disadvantages, the first that their action is so transient, and the second that they are so likely, when freely used, to produce faintness or collapse. For these reasons they are now but little used.

Cardiac failure is the great risk in pneumonia, and the knowledge of this fact yields two prime indications for treatment, first to counteract it when it develops, but, more important still, to avoid everything which tends to produce it or aggravate it. It is for this last reason that the old depressant treatment by repeated bleedings, full doses of antimony, aconite, veratrin, etc., has been abandoned, as well as most of the antipyretic remedies.

The causes of cardiac failure are not the same in all cases. It may be the result of previous disease, or be due to acute degeneration of the cardiac muscle, consequent on long continued high temperature, or to the action of some blood poison developed by the disease itself, or to over-distension of the right side from the obstruction in the lungs. Each of these causes must be treated, as best it can be, by cardiac tonics and diffusible stimulants. Of the cardiac stimulants, digitalis, strophanthus, and caffeine are the most useful. Digitalis wants watching, for it is cumulative in action, and may produce more slowing of the pulse than is wanted. Strophanthus is less to be relied upon. Caffeine combined with nux vomica is the most serviceable for prolonged use. To meet any sudden emergency, such as collapse, ether and alcohol by the mouth, or subcutaneous injections of ether or strychnine, are in common use. Adrenalin, or camphor dissolved in sterilised oil, has been administered subcutaneously. Musk and camphor may be also given in pill form.

Bleeding.—When the lungs are greatly engorged, the patient cyanosed, and the right heart over-distended, great relief may be given by bleeding. But the bleeding must be free and rapid. Several ounces—a pint or a pint and a half—should be withdrawn from a large vein rapidly. As the blood flows, the colour improves, the heart's action becomes less laboured, and the urgent symptoms may pass off. The loss of so much blood leaves the patient weak, and such a bleeding is, therefore, suitable only for special cases. The typical case is that of a young, full-blooded, healthy, well-fed adult, with florid complexion and well-developed muscles. Bleeding is contra-

indicated in weakly, unhealthy, anæmic persons, in the very young or the aged. In properly selected cases free bleeding is of great use, and has, I have no doubt, saved many lives, but in private practice prejudice often prevents its employment when it would undoubtedly do good.

Bleeding is sometimes spoken of as useful on theoretical grounds, because with the blood there are removed some of the toxines upon which some of the grave symptoms are supposed to depend. This reason does not appeal to me, and I think such a theory mischievous in practice, as likely to lead to bleeding in unsuitable cases. Dermatoclysis, or the subcutaneous injection of large quantities of water or normal saline solution, has been advocated as another way of diluting the toxines, or assisting in their elimination; but it does not commend itself to me, for it does not seem to be based on sound theory.

Stimulants are not required in an ordinary case in the healthy and young, but will probably be necessary from the first in the aged and weakly. In persons of alcoholic habits, or where nerve symptoms or marked asthenia develops, stimulants have often to be given freely. They may even be our sheet anchor, for as pneumonia, though a very intense fever, is of short duration if life can be preserved for a few days till the crisis comes, recovery will take place. Alcohol in some form is the stimulant generally used. Ether may be given, but its action is more transient, and it is often distasteful.

Oxygen is very useful, for, under its administration, cyanosis lessens, the heart beats more regularly and slowly, the patient becomes less restless, and may fall asleep. If, however, it is to do good, it must be employed early, and its administration not deferred until the patient is moribund. When given dry, it is sometimes irritating. It should be allowed to bubble through water, or, what appears to be better still, equal parts of water and alcohol.

Pain.—The stitch in the side, so commonly present at first, tends to disappear after 24 hours or so. If hot poultices do not soon give relief, other measures must be used. Subcutaneous injections of morphia or heroin locally have been used, but they are undesirable for general reasons, and are uncertain

in their action. The best and most trustworthy remedy is the application of two or three leeches over the seat of pain. This rarely fails to take the pain away, which usually does not return. Poultices are objectionable on account of their weight, and, for the purposes of counter-irritation, a spongiopilin jacket is better upon which spirits of camphor or even turpentine is freely sprinkled. The use of cold applications to the chest instead of hot has been highly recommended in the belief that they reduce temperature, check pain, and control the inflammation. Cloths wrung out of ice-cold water, an ice-bag, or Leiter's tubes with cold water circulating through them have been employed. In my own experience, cold applications have not been so successful or so agreeable to the patient as the ordinary poultice or counter-irritation.

Cutaneous hyperæsthesia is not common. When *local* it occurs, as a rule, over the inflamed parts, and may be easily removed permanently, or, at any rate, for the time, by brushing the part over with tincture of aconite.

When *general*, it may be relieved by tepid sponging, but, as it depends upon a general cause, probably toxæmic, it is more difficult to treat.

Cough is rarely severe enough to call for treatment. If it causes much distress or pain some sedative may be required, but the pain in the side is better relieved by leeches than by narcotics.

Hiccough is a very grave symptom. It is usually associated, I think, with diaphragmatic pleurisy. It causes great distress, and is very obstinate to treatment. Even morphia injections often fail to relieve.

Delirium has several causes—high temperature, some serious complication like pericarditis, previous alcoholic habits, or asthenia. These must be sought out and dealt with accordingly. For most of them stimulants are required. If sedative medicines are necessary, bromide of ammonium, with or without chloral, will be found useful, combined, if thought fit, with hyoscyamine and cannabis indica.

Hyoscyamine, which is so useful in mania, is a risky remedy in pneumonia, and I have abandoned its use.

Veronal also, in my experience, is a sedative which is not free from serious objection.

Sleeplessness is due to many causes, chief among which are pain and high temperature, which may be treated in the usual way. In children, there is no better sedative than a hot bath, and, in the adult, wet packing or a cold douche to the head may have the same effect.

If, in the adult, 24 hours are passed absolutely without sleep, something must be done to give rest, or the patient will die of exhaustion. If ordinary remedies fail, and we cannot waste much time in trying them, we are driven to consider the question of morphia.

Narcotics of any kind have to be used with great discrimination in pneumonia, if they are not to do more harm than good. The great objection to them is that they diminish the sensibility of the respiratory tract, and thus check cough and expectoration. Yet where the patient cannot sleep, sleep must be given, and if ordinary remedies fail, nothing seems left but morphia, and the greatest benefit is often obtained from it. I am always guided myself in its use by the amount of secretion in the air-tubes. The cases, in which it should *not* be used, are those in which there are the signs of congestion in the non-consolidated parts of the lung. Such cases are practically always fatal, and morphia simply accelerates the end. When the rest of the lungs is not congested, *i.e.*, shows no signs of bronchitis, morphia may be given without risk and with great benefit. If it is decided to use it, it is best given in the most effective and certain way, *i.e.*, by subcutaneous injection, and not by the mouth. When a patient is at last got to sleep by morphia, the sleep is very profound. It may be so deep that the suspicion may arise that the apparent coma is due to the morphia, but with the doses used, coma is impossible, and the deep sleep is simply that of exhaustion.

The digestive tract rarely gives any special symptoms which require active treatment. If food is refused nasal feeding must be adopted. Vomiting is rarely troublesome. Diarrhœa is more common, but both these symptoms are likely to depend much upon the diet, and are generally controlled by change of food. Looseness of the bowels is not usually important, and generally ends with the fevers.

Symptomatic treatment is often disrespectfully spoken of,

as if it was unscientific. Yet it is based upon long clinical observation and experience, and if remedies have been proved to do good, that is a fact which remains a fact even if we cannot explain it.

After all if we cannot treat the disease, we can treat the patient, and if we can relieve his symptoms, or the dis-ease or discomfort they cause, we must so far do good, and we have daily proof that we do. There is no disease in which careful watching and skilful treatment show better results than in pneumonia.

DISCUSSION.

AFTER the reading of this paper, remarks were made and opinions expressed by Drs. D. B. Lees, W. H. Blenkinsop, Percy Kidd, Sidney Phillips, Arthur Latham, Ewart, J. Edward Squire, and W. H. Willcox, of which reports or summaries follow :—

(*a*)—D. B. LEES, M.A., M.D., F.R.C.P.

Dr. Lees said : The subject, which we discuss this evening, is one of the most important in the whole range of medicine. When we remember that of every five or six cases of pneumonia one is fatal, that the total annual mortality from it is more than 1,000 per million living (which means more than 40,000 deaths every year in our population of forty millions), and that a large proportion of its victims are fathers and mothers of children, bread-winners and educators, often in important and responsible positions, whose death is an irreparable disaster to their children, to the community in which they live, and possibly to the whole nation, we cannot but be impressed with the gravity of the subject. The proper treatment of pneumonia is a question which has interested me profoundly for more than 30 years ; it was the main topic of the Harveian Lectures[1] which I had the honour to deliver before this Society five years ago. What I wish to do this evening is to state, as briefly and lucidly as possible, what seem to me the most important points of treatment, which we ought to keep in mind. And let it be remembered that every case of pneumonia is a fight for life. In every case immediate attention

[1] "The Treatment of some Acute Visceral Inflammations," 1904.

is necessary; rest in bed, skilled nursing, and a visit of the doctor twice a day are essential.

I. *The Right Heart.*—It is the right heart which fails in pneumonia—rarely the left. The left heart may be dilated, if there is a concurrent infection by influenza, diphtheria, typhoid, or rheumatism, or if the heart or arteries have been previously diseased. But, in an ordinary pneumonia in a previously healthy person, careful percussion shows that the left border of the cardiac dulness is only slightly displaced to the left, not more than the distension of the right side will account for. But a dilatation of the right auricle may often be detected on the third day of a pneumonia—sometimes even on the second day. This observation is not difficult if careful light percussion is practised in the innermost part of the fourth right interspace. In the normal heart, the right auricle yields a dulness at this spot which measures about a finger-breadth (2 centimetres). In pneumonia, this often increases to two finger-breadths, and then there will be one finger-breadth in the third space also. A rapid dilatation of the right heart always gives rise to acute dyspnœa, and with the dyspnœa are associated a dusky pallor, a small pulse, a sense of cardiac oppression, restlessness, and inability to sleep: symptoms which may be summed up as *right-heart misery*. Immediate relief may be given by a few leeches, applied between the right nipple and the costal margin, but, in neglected cases, venesection may be necessary. The relief will usually last for 48 hours, but it may then be found that the auricle is again dilated, and that the urgent symptoms have returned. The leeches or venesection should then be repeated. Two small bleedings, often only one, will usually suffice to carry the patient in comparative comfort to the time of the crisis.

II. *The Lungs.*—At one or more places, in one or both lungs, a rapid multiplication of pneumococci is taking place, with steady production of toxins. Fortunately, the pneumococcus is very susceptible to changes in its environment, and, in particular, to changes in temperature of the culture-medium. Bacteriological investigation has demonstrated that a lowering of temperature of as little as 6°–10° C. causes a marked reduction in the number of colonies formed in a given

time. Careful clinical observation of cases of pneumonia treated by icebags has shown that, after an icebag has been applied over a pneumonic area for several hours, it is usually possible to demonstrate a diminution in the degree of dulness at the spot where the ice has been, frequently also a diminution in extent of the dull area, and, in addition, a freer air-entry. Small areas of recent origin often become completely resonant in a short time. For more than 20 years, I have employed this method of treatment, and have found it extremely efficient, if the following points are attended to :—

(1) The feet and lower limbs must be kept constantly warm by additional hot-water bottles; (2) the condition of the right heart must first be ascertained, and any considerable dilatation relieved by leeches; (3) the precise position and extent of the dull areas in both lungs must be ascertained by careful percussion; (4) two icebags—one in front and one behind—must be applied so as to have the worst area between them; (5) if possible, after a few hours, a third icebag, and perhaps a fourth, should be applied to the next greatest area; even a fifth icebag is often tolerated, with skilful nursing; (6) the physical signs must be carefully ascertained at least once every day, and the position of the icebags shifted accordingly; (7) nothing must intervene between the icebag and the skin; (8) the ice must be renewed as often as necessary, about every two hours.

The ice gives so much relief that the frequent disturbance is gladly tolerated by the patient, provided (and this is essential) that the right heart is not over-distended.

III. *The Mouth, Throat, Nose, and Air-Passages.*—It is practically certain that the infection of the lung depends upon the presence of the pneumococcus in the mouth, throat, or nose. It is, therefore, of extreme importance to arrest the further supply of infective material by a careful antiseptic treatment of these cavities. The mouth should be rinsed with equal parts of Sanitas fluid and water; the throat sprayed with 1 in 2000 solution of perchloride of mercury in glycerine and water; the nose sprayed with a parolein spray containing a little oil of eucalyptus and 1 per cent. of cocaine. Each of these measures should be carried out at least three times daily. In addition, I have observed much benefit from the

constant wearing of a Yeo's "respirator-inhaler," the sponge of which is saturated with a combination of volatile antiseptics:—carbolic acid, creasote, and iodine, with spirit of ether and spirit of chloroform. Unless dyspnœa is specially great, patients can wear this simple inhaler without difficulty. If the dyspnœa is too great, probably the right auricle will be found to be in need of relief.

IV. *Sleep.*—Sleep is of the first importance; not a single night's rest can be spared. At his first visit the physician must ensure that the patient shall sleep the following night. At first the causes of sleeplessness are pain and pyrexia; both can be checked by icebags, but the former often requires subcutaneous morphine. In the early days of the disease, morphine is absolutely safe, and is of the greatest assistance. If any other drug is required, let it be chloralamide (not chloral), or bromide with brandy. But sleep is essential. When the right heart is much dilated morphine is a dangerous drug. But if the right heart has been relieved, and ice applied to the lung, the patient will often fall asleep without any hypnotic. But, if needful, morphine may now be given without fear.

V. *Diet.*—Milk is the food most easily taken. Both its digestibility and its nutritive value may be increased by adding to it malted-milk powder, which is composed of desiccated milk, malted barley and wheat, and some alkaline salts. Half an ounce of this in 6 to 8 ounces of milk every three hours will be sufficient. But when the right auricle is strained, it may be wise to reduce the quantity of fluid in the food, and to give only 2 ounces of milk with the half-ounce of malted-milk every two hours. When the right heart has been relieved by leeches or venesection, it is safe, and beneficial, to give large quantities of water by the mouth, both to satisfy thirst and to assist in the elimination of toxin by the kidneys. Half a pint of water may be given every three hours, 4 pints in all, during the day after the bleeding. This is of considerable value.

VI. *Respiratory Stimulants.*—The hypodermic administration of Liquor Strychninæ should be begun as early as the fourth day. The dose should be rapidly increased to 6, 8, or even 10 minims, and, in the later part of the attack, it should be given twice or three times daily. Oxygen is distinctly helpful, but I have never seen it save a life. Fresh air, without

draught, should be freely supplied. A "bronchitis-kettle" should never be allowed. Ammonium carbonate may be useful if there is much bronchitis present. In pneumonia, apart from influenza, the value of alcohol, quinine, or digitalis is, I think, doubtful. Atropine is useful, but too apt to increase delirium.

The worst cases of pneumonia are those in which much bronchitis is present, and especially the septic cases, in which the temperature ranges below 102°. Many of these offer no hope of successful treatment, unless a therapeutic serum or a vaccine can be made available, and of this there is no immediate prospect. Patients suffering from diseased heart, lungs, liver, or kidneys, from feeble vitality, from general constitutional disease, or from chronic poisoning by alcohol or tobacco, have but a poor chance of recovery from pneumonia. Yet some of these may be saved with care, and I am convinced that, if the measures advocated above are adopted, a very considerable reduction may be effected in the total mortality from pneumonia.

(*b*)—W. H. BLENKINSOP, B.A., M.B., M.R.C.P.I.

Dr. W. H. Blenkinsop gave an account of his personal experience in practice in the treatment of pneumonia. He laid great stress on the importance of active measures in combating the effects of the disease. He had found local bleeding by the application of leeches of great service in the early stages, and also that the application of local remedies, such as croton oil liniment, was of great benefit in many cases. He believed that stimulants were of great benefit, and that their application should not be postponed until too late. He had found the use of alcohol very valuable in many cases.

(*c*)—PERCY KIDD, M.A., M.D., F.R.C.P.

Dr. Percy Kidd said: It would be impossible to discuss the various points raised by Dr. West's paper, and by other speakers. I shall, therefore, confine myself to a few points. I was glad to hear what Dr. West said about the use of leeches. For the relief of pain, I believe there is nothing to compare with them, and I have never known them to fail. My

experience leads me to doubt whether the merits of leeches are adequately appreciated by the majority of practitioners at the present time. It has happened to me several times at consultations, in cases of pneumonia, when I have suggested the use of leeches, to be met with the remark that it would be almost impossible to get them at the local chemists, and that it would be necessary to send to one of the large London firms for them. I fully recognise the importance of careful cleansing of the mouth to which Dr. West alluded, but I should hesitate to adopt the somewhat drastic local treatment of the naso-pharynx and mouth advocated by Dr. Lees, in view of the disturbance of the patient that it would involve. For I believe that rest is of the utmost importance in every case of pneumonia, and, when once the diagnosis has been established, the less the patient is disturbed for physical examination the better during the active phase of the disease.

And, while I agree with Dr. Lees as to the very great importance of the state of the heart, I would urge that the condition of the nervous system is almost as decisive. The onset of severe nervous symptoms, such as delirium, tremor, restlessness (I do not refer now to alcoholic cases), is a very bad omen, indeed, in many of these cases, the prognosis is hopeless from the first with our present methods of treatment.

We know that the great danger of pneumonia is toxæmia, and it is probable that cardio-vascular and respiratory failure in this disease is largely attributable to implication of the nervous system. The treatment of restlessness and insomnia is, therefore, a matter of the greatest moment to the patient. I should like at this point to make a few remarks about the use of opium. My attention was strongly directed to this question by a paper written by Sir Samuel Wilks, more than 15 years ago, in which he examined and criticised the superstition that opium is absolutely contra-indicated in pneumonia, and gave instances of the beneficial action of the drug in certain cases. Since that time I have frequently used opium for the relief of insomnia and restlessness with excellent results. Of course it must be given with discretion, and I should say that, for the first three or four days of the disease, it may be safely administered, preferably in the form of an injection of morphia

gr. $\frac{1}{6}$ to gr. $\frac{1}{4}$, at night, provided that cyanosis and other signs of respiratory failure are absent. After the fourth day, and until the crisis has been passed, I should be very chary of prescribing opium. Though, in some of the less severe cases, sponging, bromides, and other remedies may suffice, many troublesome cases of restlessness and insomnia can only be relieved by opium, and the relief afforded by a few hours' sleep may be of vital importance to the patient.

As regards stimulants, I should rely on alcohol and strychnine, which I believe to be safer and more effectual than digitalis. But strychnine should be given in sufficient doses, by hypodermic injections, and at an early date, the chief indications for its use being a weak and rapid pulse. Thus, in a young child, $\frac{1}{100}$ grain may be given every three hours for four or five doses, and then continued at larger intervals, if necessary.

(*d*)—SIDNEY P. PHILLIPS, M.D., F.R.C.P.

Dr. Sidney Phillips thought, in treating pneumonia, that it was important to consider what were its chief dangers: hyperpyrexia occurred in only 2·8 per cent. of 593 deaths in adult pneumonia cases collected from the metropolitan hospitals, and was therefore a very rare cause of danger. He did not think right heart failure was the commonest cause of death; the circulation was possible without any contraction of the right ventricle, but intra-cardiac thrombosis, contributed to by the hyperinotic state of the blood in pneumonia, was likely to occur when the right heart was overloaded. Dr. Walshe wrote that the commonest cause of death in pneumonia was asphyxia, but probably some of the cases ascribed to asphyxia were toxæmia, which Dr. Phillips thought was by far the commonest cause of death in pneumonia. And the period of danger was usually just at or after the crisis. It was at this time that, in a case of local *unilateral* pneumonia, one found that the lungs *on both sides* were apt to become suddenly the seat of profuse bronchial flux, which swamped the lungs, and almost invariably the patient died. He thought this could only be attributed to paralysis of the muscular fibres of the bronchi, the result of profound toxæmia acting on the nervous system. Dr. Phillips thought a cardinal point in the treatment was to guard against

this by commencing the administration of alcohol, digitalis, and strychnine about the fifth day of the disease, and, whenever there were indications of collapse at the crisis, to ply these stimulants with the greatest freedom, even to 20 ozs. of alcohol a day, and though treatment might be of little avail in pneumonia, he thought death was sometimes averted by free stimulation at the crisis. Dry cupping was useful at the commencement of the disease, but he thought venesection at that stage of little effect, though very useful if the venous system was much engorged later on. Statistics showed pneumonia to be most fatal at certain seasons of the year, and when the air was very dry, the wind east, the temperature low, and if there was fog, he thought the steam kettle very useful. Quinine was a non-depressing antipyretic, which was useful, if given about the time of the crisis, assisting the natural fall of pyrexia; oxygen inhalation was serviceable, and the more continuously it could be given the more valuable its effect.

(*e*)—ARTHUR LATHAM, M.A., M.D., F.R.C.P.

Dr. Arthur Latham said that the treatment of pneumonia was far from satisfactory at the present time. It was clear from the discussion that very different views were held as to the proper line of treatment. It was also well known that in the various London hospitals very different lines of treatment were adopted. The statistics, recently prepared for the Royal Society of Medicine, showed that, in spite of these differences, the mortality from pneumonia was almost identical in the large London hospitals. This mortality amounted to 20 per cent.; in other words, one person in five treated for this disease died. That fact was sufficient to show that it was their duty to see whether the treatment of pneumonia could not be improved upon. In his opinion, the treatment of pneumonia, apart from the question of vaccine treatment, to which he would refer later, was summed up under two headings. (1) The necessity of limiting the absorption of toxin, *i.e.*, the prevention of auto-inoculation; (2) symptomatic treatment. It was absolutely essential that a patient suffering from pneumonia, or indeed from any acute intoxication,

should be treated, so far as movement was concerned, on exactly the same lines as a patient suffering from enteric fever. The reason for this was that movement increased the amplitude of the respiration, and so led to a free circulation of the lymph and to a greater absorption of toxin. It had been shown by Freeman and others that massage of a joint, infected by gonococci, led to a greater absorption of toxin, and that this could be shown by its effect on the opsonic curve, and, in some cases, by the clinical results. Again, heavy percussion of the chest of a patient, suffering from pulmonary tuberculosis, had been shown to have exactly the same effect on the opsonic curve as an injection of tuberculin, that was to say, heavy percussion might be followed by an increased absorption of toxin. How sensitive this auto-inoculation was, could be best demonstrated in a case of tuberculous laryngitis. If a patient, suffering from this disease, read aloud for an hour, the movement was sufficient to cause a greater absorption of toxin, and the effect on the opsonic curve here also was exactly the same as the effect produced by an injection of tuberculin. The practical deduction was that the less a patient suffering from pneumonia was moved, the better were his chances of recovery. He had watched the practice of several physicians in this country and abroad, who were in the habit of making a daily and elaborate examination of the chest in this disease, and even of sitting their patients up for this purpose. He was satisfied that this resulted in a greatly increased mortality. Again it was an undoubted clinical fact that a patient, who was treated with complete rest from the initial stages of the disease, had a better chance of recovery than a patient, who was moved from his home in some jolting vehicle on the fourth, fifth, or sixth day of the disease. He did not suggest that no examination of the patient's chest should be made from day to day, but no movement, causing any respiratory exertion, should be allowed. The anxious search of some physicians for the presence of fluid or pus seldom gave any information in the first week of the disease, and the careful mapping out of the area of consolidation seldom if ever led to any advantage to the patient. All the information required could be obtained by light percussion and auscultation, and a careful examination of the position of

the heart.

With regard to symptomatic treatment, he believed that oxygen should be used from the commencement of the disease, but that it should be administered in such a way that it was freely diluted with air. Given in this way, it did much to limit respiratory embarrassment or movement. He had great faith in the value of leeches for reducing the initial pain. He never hesitated to give small doses (gr. $\frac{1}{6}$ to $\frac{1}{4}$) of morphia hypodermically in pneumonia, at any stage of the disease, if there was not much associated catarrh of the other portions of the lung. He believed that morphia was the best drug for sleeplessness in this disease, and that the use of veronal might be attended with most unpleasant results in any condition resulting from profound toxæmia. With regard to stimulants, he waited until the pulse showed some sign of flagging, and then gave strychnine and digitalin together hypodermically, with increasing doses of alcohol, until the crisis was past. He thought that it was not sufficiently borne in mind that the crisis was a critical time. Patients often died immediately after the crisis, because these stimulants had not been given in sufficient doses as the temperature came down, and for 24 hours afterwards.

He had said that the present day treatment of pneumonia was far from satisfactory, and he believed that, in the near future, a great advance might be made by the adoption of vaccine treatment. The lung tissue had some peculiar power of resistance to the pneumococcus, for an abscess of the lung, as the result of pneumonia, was very rare, whilst in other situations the pneumococcus frequently led to abscess formation. This fact encouraged the belief that vaccine treatment might be of great service. The results of vaccine treatment obtained by Boellke, in a few cases of severe pneumonia and one case of pneumococcic endocarditis, were most encouraging. The results of vaccine treatment in cases of delayed resolution of the lung, and in pneumococcic infection of other portions of the body, were also most encouraging. He had recently been able to show that it was possible to produce immunisation against bacterial invasion by the administration of the appropriate vaccines, *e.g.*, tuberculin, staphylococcic, streptococcic, by the mouth. In two cases of pneumonia he had recently

administered dead pneumococci by the mouth, and in both cases this was followed in eight hours by a marked fall in the temperature, which was progressive, in one case on the third day, and in the other on the second day.

(*f*)—WILLIAM EWART, M.D., F,R.C.P.

Dr. Ewart approved of the use of leeches in pneumonia both for the relief of pain, when applied locally in the early stages, and also later for the relief of the over-distension of the right heart, which was indicated by the marked cyanosis of the patient.

He thought that it was a great mistake to postpone the use of stimulants, and strongly advocated their use early when the patient was in a position to absorb them. He had found alcohol in the form of wine very valuable, and, where milk was ill borne, he believed that whey in liberal amounts was a most useful form of nourishment.

(*g*)—J. EDWARD SQUIRE, C.B., M.D., M.R.C.P., D.P.H.

Dr. J. Edward Squire spoke of the good effects of alcohol in certain cases. He urged the importance of complete rest for the patient, and spoke of the dangers of too frequent clinical examination, as he believed that this in some cases delayed, and even obviated, the crisis. He had found dry cupping very valuable, and believed that this remedy was not used nearly enough in this country in the treatment of pneumonia. He insisted on the great importance of allowing the patient plenty of fresh air, and spoke of the good results which he had seen follow the open-air treatment of pneumonia.

(*h*)—W. H. WILLCOX, M.D., B.Sc., M.R.C.P., D.P.H.

Dr. W. H. Willcox had seen remarkable benefit result from the proper application of bleeding, either by means of six or more leeches over the right hypochondrium, the bleeding being encouraged by hot fomentations afterwards, or else by a venesection. The secret of success in the use of bleeding was the proper selection of cases in which to apply it. Bleeding was of very great benefit in cases, in which there was over-distension of the right side of the heart. This was indicated

by marked cyanosis and dyspnœa, by visible pulsation in the epigastric region caused by the distended right ventricle, and by an increase in dulness to the right side of the sternum in the fourth interspace, which was produced by the over-distended right auricle.

The dulness in this region, in cases of right heart distension, often extended to one or two inches to the right of the sternum, the normal extent of dulness in this region being only about half an inch. In cases with these signs, bleeding was always of benefit. If venesection was performed, Dr. Willcox considered that the removal of four or five ounces of blood was quite sufficient, because the sole object of venesection was relief of over-distension of the right side of the heart. He had several times proved, by actual percussion of the extent of the right border of the heart before and after venesection, that the removal of this quantity of blood caused the dulness, to the right side of the sternum to become reduced to the normal limit. The removal of greater quantities of blood was only calculated to enfeeble the patient, and, in addition, it prevented one from safely repeating a venesection, should the right heart become again embarrassed, as sometimes happened in cases of broncho-pneumonia, where two small venesections at intervals were often of great value. He considered that the reason that venesection had found disfavour with many people in cases of pneumonia, was that it had been applied in unsuitable cases. It should not be performed in cases in which the left ventricle was failing, and the right heart not over-distended, since it might do harm. This condition often resulted in influenzal and other toxic types of pneumonia, and it was recognised by the greyish slightly flushed complexion, by the feeble pulse and weak heart sounds. The dilatation of the left ventricle could easily be demonstrated by the increase in the extent of the dulness of the left border of the heart, the dulness reaching an inch or so to the left of the left nipple line.

Dr. Willcox advised, in cases of heart failure, the use of oxygen which was bubbled through a wash-bottle containing absolute alcohol. He had used this with great benefit, in some cases of pneumonia with failing heart, the oxygen being administered through an inverted glass funnel held over the mouth and nose. He was led to try this remedy from the

observation of some experiments made in the Physiological Laboratory of St. Mary's Hospital by Dr. Collingwood.

It had been undoubtedly proved that, in animals suffering from heart failure as the result of an overdose of chloroform, oxygen bubbled through absolute alcohol had an extraordinary stimulating effect on the heart, and often caused it to recover when oxygen alone had quite failed. He considered that the use of oxygen, bubbled through absolute alcohol, was worthy of extended trial in cases of pneumonia with cardiac weakness.

Dr. Willcox laid stress on the importance of the examination of the chest in cases of pneumonia. This should be done with as little disturbance to the patient as possible. The physical signs of the front of the chest can readily be ascertained without discomfort to the patient, and, by gently rolling him on to the side, the back of the chest can be quickly examined without any harm resulting from the temporary movement.

Prolonged examination and heavy percussion were no doubt harmful, but it was quite easy for a patient to be examined once a day, and the physical signs determined without any harm resulting, provided that due care was exercised. In some cases of pneumonia, an empyema developed early, and, unless the physical signs were carefully watched, such a complication would not be recognised, and possibly a fatal result occur, which might have been obviated. He believed that great benefit would result from the inoculation of cases of pneumonia with a vaccine made from the pneumococcus organism. This method of treatment had been little used at present, but the results so far were very promising. He had applied this form of treatment in a severe case of pneumonia following on pneumococcal peritonitis. The pulmonary symptoms persisted in a very acute form for over three weeks, no crisis resulting. And it was only on the application of treatment by inoculation, with an appropriate vaccine, that the patient commenced to improve, and then speedily made a rapid recovery.

POLYCYTHÆMIA IN DISEASES OF THE HEART AND LUNGS AND DURING RESIDENCE AT HIGH ALTITUDES.[1]

By F. PARKES WEBER, M.D., F.R.C.P.,

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In healthy men the average number of red corpuscles in a cubic millimetre of blood is roughly taken as about five millions, in women, it is slightly less. "Polycythæmia," or more exactly, "polycythæmia rubra," that is to say, an abnormally large number of red cells in the cubic millimetre of the blood, may be of two kinds, absolute and merely relative.

(1) Mere relative polycythæmia is due to concentration of the blood, such as may be caused by choleraic diarrhœa or other excessive fluid discharges from the body (copious sweating). It is doubtless almost always of only temporary occurrence (possible exceptions occur in some cases of recurring night-sweats, etc.), and the diminution in volume of the blood-plasma, which causes it, is quickly recovered from when the normal osmotic conditions are re-established. Some degree of local relative polycythæmia can be induced (experimentally or by disease) in one limb or in one part of the body by obstruction to the return of venous blood from the part in question; the explanation of this is that the delay of the blood-flow allows longer time for lymph to leave the blood-vessels, and so gives rise to local blood-concentration.

(2) In absolute or true polycythæmia (polycythæmia rubra vera) the total number of red corpuscles in the body is increased, and there is evidence to show that in most if not in all cases of absolute polycythæmia the total volume of blood in the body is increased as well as the number of corpuscles. It is quite probable that in certain patients with cardiac valvular defects, etc., a condition of absolute polycythæmia exists unaccompanied (owing to simultaneous relatively greater increase in the total volume of blood) by relative polycythæmia, but we need now only consider those

[1] The substance of a lecture delivered at the Mount Vernon Hospital Post-graduate Course.

cases in which the presence of absolute polycythæmia is evidenced by the persistence of a relative polycythæmia discovered on making a blood-count in the ordinary way.

The possibility of cases of absolute polycythæmia being regarded as cases of mere relative polycythæmia (*i.e.*, mere blood-concentration) is unlikely for the following reasons :—

(1) The absence of the recognised causes (diarrhœa, excessive sweating, etc.) of diminution in the total quantity of blood.

(2) The plethoric (full-blooded) or congested appearance of the patient.

(3) The persistence of the polycythæmia (merely relative polycythæmia, as already stated, is almost always only temporary).

(4) In some cases, moreover, as we shall subsequently point out, the total quantity of blood in the body can be estimated and proved to be in excess of the average.

Cases of absolute polycythæmia may be divided into the following classes :—

A.—Those due to imperfect oxygenation of the blood and tissues owing to circulatory disturbance in chronic cardiac and pulmonary diseases. To this class we might add the polycythæmia occasionally following carbon monoxide poisoning and other toxic conditions interfering with the proper oxygenation of the blood.

B.—Those connected with living at high altitudes and diminished oxygen-tension in the inspired air.

C.—Those classed under the heading "Splenomegalic Polycythæmia," or, as I have termed them, "Myelopathic Polycythæmia."

In all these classes of absolute polycythæmia, but especially in Class C., the increase in the number of red cells is sometimes very remarkable. In cases of congenital heart disease, with more or less chronic cyanosis, blood-counts of seven to eight million red cells to the cubic millimetre are not at all unusual, as in the case of a girl, aged 17 years, whom I showed at the Clinical Society of London in 1907,[1] and whose red corpuscles had varied from 6,375,000 to 7,352,000 in the cubic millimetre.

[1] *Clinical Society's Transactions*, Vol. XL., p. 251.

In a woman aged 21 years with congenital heart disease and cyanosis, H. Batty Shaw [1] recorded a count of 8,320,000 red cells, and a hæmoglobin-value of 150 per cent. of the normal standard. Some authors formerly thought that in chronic cyanosis connected with heart disease the red corpuscles never exceeded eight millions per cubic millimetre, but Friedel Pick as far back as 1904 reported a case of congenital pulmonary stenosis in a seven-year-old girl with a blood count of over ten million red cells.[2] Quite recently at the Clinical Section of the Royal Society of Medicine (November 8th, 1907), Murray Leslie showed a woman aged 22 years with congenital heart disease, who had cyanosis and clubbing of the fingers from birth, and whose blood was found to contain over 11,000,000 red cells to the cubic millimetre. In three patients at the German Hospital with cyanosis connected with chronic pulmonary emphysema and circulatory insufficiency we obtained blood counts of respectively 6,350,000, 6,850,000 and 6,870,000 red cells per cubic millimetre, and in a fourth case the counts on various occasions were 6,930,000, 8,230,000 and 9,357,000. In normal persons the "polycythæmia of high altitudes" (including that of residence at localities 6,000 feet or more above sea level) may reach seven to eight million red cells per cubic millimetre of blood. In cases of so-called splenomegalic polycythæmia, however, counts of nine to ten million red cells and over have been fairly common, with hæmoglobin-values up to 160 to 180 per cent. of the normal standard, and even higher. If samples of such extremely polycythæmic blood (in which coagulation has been prevented by the addition of citrate or tartrate of potassium) are allowed to stand in a cylindrical glass vessel until the corpuscles have had time to settle down, it will be found that the corpuscular sediment occupies over nine-tenths of the whole column, the blood-plasma forming only a thin layer on the surface; whereas in normal human blood the corpuscular layer and the layer of blood-plasma are about equal in volume.[3]

[1] *Clinical Society's Transactions*, Vol. XL., 259.

[2] Verein Deutscher Aertze in Prag, 22nd January, 1004.

[3] There is said not to be even "standing-room" for more than about thirteen million red blood-cells to the cubic millimetre, as Dr. R. Hutchison has expressed it. Yet blood counts of more than thirteen million red cells to the cubic millimetre have been recorded by some observers.

It is probable, as I have already mentioned, that in absolute polycythæmia the total volume of blood in the body is generally, if not always, above rather than below the normal average, that is to say, the quantity which should correspond to the body weight. In 1900 J. S. Haldane and Lorrain Smith published their "carbon monoxide method" of estimating the total volume of blood in the body,[1] a method which made it clinically possible to recognise the presence of true plethora, and in 1906 C. G. Douglas[2] tested this method in animals and found that the results obtained by it agreed fairly closely with those obtained by the old Welcker's method in which the blood had to be extracted from the tissues after the death of the animal. The carbon monoxide method has been already employed in various cases of true polycythæmia in man. Lorrain Smith and H. L. McKisack,[3] in the case of a boy, aged 12 years, suffering from adherent pericardium and chronic cyanosis, not only showed that the proportion of red cells to blood-plasma was excessive (relative polycythæmia), but also demonstrated by the carbon monoxide method that the total volume of blood was far beyond the normal standard, so that there was undoubtedly a condition of true plethora present. The number of red cells in the cubic millimetre of blood was 6,340,000, and by the carbon monoxide method it was ascertained that the total volume of blood in this boy's body was nearly double that of the normal standard. In the case of splenomegalic polycythæmia which I described in Volume LXXXVIII. of the *Medico-Chirurgical Transactions*[4] the total volume of the patient's blood was estimated in the same way by Haldane himself, and was found to be greatly in excess of the normal. In fact with a blood-count of between eight and nine million red cells to the cubic millimetre and with a hæmoglobin-value, of about 150 per cent. of the normal standard, there was likewise a great excess of the total blood-volume, that is to say, a condition of true plethora was also present. This is exactly what one would suppose from the plethoric look of such

[1] *Journal of Physiology*, London, 1900, Vol. XXV., p. 331.
[2] *Journal of Physiology*, 1906, Vol. XXXIII., p. 493.
[3] *Transactions of the Pathological Society of London*, 1902, Vol. LIII., p. 136.
[4] *Medico-Chirurgical Transactions*, London, 1905, Vol. LXXXVIII., p. 191.

patients and from the engorged state of their visceral blood-vessels as revealed at the few post-mortem examinations which have as yet been recorded. I have Dr. T. D. Acland's permission to state that in an as yet unpublished case of splenomegalic polycythæmia under his care at St. Thomas's Hospital, Dr. Haldane made a clinical estimation of the total blood-volume by the carbon monoxide method and showed that it was about two and half times the normal. Dr. R. Hutchison also kindly informs me that in two typical cases of splenomegalic polycythæmia (accounts of which have not yet been published) at the London Hospital Dr. A. E. Boycott determined the total blood-volume by Haldane and Lorrain Smith's method and found it in both cases very much increased, in one of the two cases indeed it appeared to reach the extraordinary figure of 10,750 cubic centimetres, that is to say, probably more than three times the volume normally corresponding to the patient's body-weight. In regard to the polycythæmia of high altitudes there is less evidence of associated polyæmia (true plethora) in human beings, but A. Jaquet and F. Suter[1] found that in rabbits kept at high altitudes (Davos) a very striking increase occurred, not only in the number of red corpuscles and richness in hæmoglobin per cubic millimetre of blood, but likewise in the total quantity of blood (and hæmoglobin) which could be extracted from the body.

What is the cause of the numerical increase of the red-blood corpuscles in the various classes of absolute (true) polycythæmia? In regard to the polycythæmia of chronic cardiac and pulmonary diseases there can now be no doubt that imperfect oxygenation of the blood and tissues is the exciting cause of the polycythæmia, in fact, that deficiency of oxygen, as was many years ago suggested, stimulates the functions of the red bone-marrow so as to cause an increased formation of red cells. According to this view the polycythæmia is a "conservative" or "compensatory" vital reaction on the part of the individual, an automatic attempt to make up for deficient oxygenation of the tissues by increase in the number of the red blood-cells, which are the oxygen-carriers of the blood. Post-mortem examinations in cases of chronic cyanosis of cardiac or pulmo-

[1] *Korrespondenzblatt für Schweizer Aerzte*, 1898, No. 4.

nary origin help to confirm this hypothesis, for, in such cases, although the red colour of the bone-marrow of the shafts of the long bones is partly due, as I have satisfied myself, merely to engorgement with blood, evidence of abnormal hæmopoietic activity is likewise obtained. It is surprising, however, that in this respect very few exact observations have as yet been recorded. The polycythæmia of high altitudes,[1] which is now at last universally allowed to be an absolute or true polycythæmia, must be explained in the same way, as indeed F. Miescher suggested in 1893.[2] It represents, in fact, a conservative vital reaction on the part of the individual (that is to say, on the part of his bone-marrow) to compensate for the diminished oxygen-tension in the inspired air at high altitudes, *i.e.*, to compensate for the resulting difficulty in maintaining proper oxygenation of the blood and tissues of the body. Animals when kept at high altitudes react by a polycythæmia just as men do, and the bone-marrow of dogs which have developed a polycythæmia from being kept at high altitudes, has been carefully macroscopically and microscopically examined and found to give abundant evidence of increased erythropoietic activity.[3] I have already quoted Jaquet and Suter's observations on the increase of blood-corpuscles and hæmoglobin in rabbits when kept at Davos, the famous Swiss mountain resort. Jaquet[4] obtained quite similar results (nearly parallel increase in the figures) by keeping rabbits in chambers, in which the atmospheric pressure was artificially reduced[5] to correspond to a fall of 100 mm. in the height of the barometic column, which is equivalent to a rise of over 1,000 metres in altitude. Similar experiments

[1] Most of the very extensive literature on this subject was recently shortly summed up in *Climatotherapy and Balneotherapy*, by Sir H. Weber and F. Parkes Weber, Third Edition, London, 1907, pp. 60–62.

[2] *Korrespondenzblatt für Schweizer Aertze*, 1893, No. 24.

[3] See *Höhenklima und Bergwanderungen*, by N. Zuntz, A. Loewy, F. Müller and W. Caspari. Berlin, 1906, pp. 198–200.

[4] *Arch. fur exper. Pathologie u. Pharm.*, 1901, Vol. XLV., p. 1.

[5] Paul Regnard (*La Cure d'Altitude*, Paris, 1897) had already maintained that in animals an artificial atmosphere containing excess of oxygen reduced the number of red cells in the blood, and he had also increased the hæmoglobin-value of the blood by subjecting animals to an artificially rarefied atmosphere. But the value of his results was called in question owing to the artificial conditions to which the animals were subjected and by the possibility of excess of carbonic acid playing a part in the latter experiment.

had been carried out by O. Schaumann and E. Rosenquist [1] on dogs, rabbits, and pigeons. They were kept in an artificially extremely rarefied atmosphere, corresponding to an altitude of about 4,000 metres, and by this means not only were the red cells (erythrocytes) increased in number, but in the case of the dogs and rabbits nucleated red cells (erythroblasts), that is to say, young unripe forms of red cells, were made to enter the circulating blood from their normal home in the bone-marrow. Various observations quoted by Jaquet and others show that the changes in the quality and quantity of the blood which occur as the result of living at high altitudes and which can be experimentally produced by subjecting animals to an artificially rarefied atmosphere, cannot be explained as the effects of low temperature or increased light. As further confirmation of these views it may be mentioned that E. Kuhn [2] by the use of his so-called "suction-mask," that is to say, by periodical artificial diminution of the oxygen-pressure in the lungs has apparently been able to produce a decided increase of red cells in the blood.[3]

In regard to the cause of the polycythæmia in cases of so-called "splenomegalic polycythæmia" (a numerical increase in the red cells which, owing to the appearance of cyanosis, might, on first examination, in some cases be mistaken for that dependent on chronic cardiac or pulmonary direases), nothing certain is at present known, excepting that, as the changes found in the marrow of the shafts of the long bones at post-mortem examinations have shown, it is brought about by increased activity in the erythropoietic functions of the bone-marrow. But an increased activity of the bone-marrow is doubtless also the immediate cause of the other classes of absolute polycythæmia, as I have already pointed out when discussing the classes of polycythæmia dependent on chronic cardiac and pulmonary diseases, or on residence at high altitudes. There is no evidence that increased durability of the red corpuscles (increased resistance of the corpuscles

[1] "Ueber die Natur der Blutveranderungen im Höhenklima," *Zeitschrift für klin. Medizin*, Berlin, 1898, Vol. XXXV., p. 126 and p. 315.

[2] *Münchener med. Wochenschrift*, 1907, No. 35, p. 1713.

[3] I may here mention, however, that I am not at all convinced of the general clinical applicability of Kuhn's "suction-mask" (which I have myself, however, tried in only very few cases) for producing an increase of red cells and næmoglobin in the blood of anæmic and tuberculous patients.

towards hæmolysis, etc.) plays any essential part in the causation of any kind of polycythæmia.

The relation of absolute polycythæmia (polycythæmia vera) to polyæmia (plethora vera).—Not many years ago the possibility of the persistence of a condition of plethora was denied by most authorities. R. von Limbeck, in the second edition (English translation, 1901) of his *Clinical Pathology of the Blood*,[1] wrote:—"The doctrine of plethora, formerly a dogma, has received its death-blow, owing to the growth of experimental investigation. It was especially due to the works of von Lesser, Worm-Müller and Cohnheim that the possibility of the persistence of a condition of plethora came to be denied." In 1900, J. Lorrain Smith,[2] by the "carbon-monoxide method" previously referred to, proved that in the so-called anæmia of chlorosis, the volume of the blood was in reality greatly increased (in proportion to the severity of the disease), and now, as we have already pointed out, it appears that true (absolute and persistent) polycythæmia is always or almost always associated with a condition of true plethora (polyæmia).

Are there any experimental observations which throw light on this association of true plethora with polycythæmia? Yes, I think there are some, and, curiously enough, they are the very experiments of Worm-Müller (1875) on which Cohnheim based his assertion that plethora could not exist. These experiments and those of Von Lesser (1874) did, indeed, prove the impossibility of suddenly producing a persistent plethora by the experimental transfusion method, but, at the same time, they wonderfully well illustrate the manner in which a condition of persistent polycythæmic plethora may arise under certain pathological (chronic cardiac disease, etc.) or physiological (residence at high altitudes) conditions. I shall, therefore, shortly describe the experiments in question as given in Von Limbeck's work[3] already referred to. When Von Lesser and Worm-Müller tried to produce plethora artificially by transfusion of blood into an animal, the blood-vessels were at first enlarged to receive the excess and the blood-pressure was augmented, but a portion of the injected

[1] English translation by A. Latham and J. Nachbar, New Sydenham Society, 1901, p. 63.

[2] *Transactions of the Pathological Society of London*, 1900, Vol. LI., p. 311.

[3] *Loc. cit.*, p. 63.

blood quickly began to leave the vessels, the lymph-stream increased, and the increase in the blood-volume gave place to an increase of blood-corpuscles (polycythæmia), which in its turn gradually disappeared. No bad symptoms were observed when the quantity of blood transfused amounted even up to approximately 80 or 100 per cent. of the (estimated) normal total blood-volume in the animal's body. Within half an hour after the transfusion, half the injected fluid had already, according to Worm-Müller, left the blood-vessels, though the cellular elements remained, giving rise to a polycythæmia. In the case of a rabbit transfused for 15 minutes from another rabbit, the red corpuscles counted before the experiment were 5,160,000 to the cubic millimetre, but 22 minutes after the transfusion they were 8,280,000 to the cubic millimetre. In these experiments the polycythæmia did not last long. Worm-Müller found that the number of corpuscles was reduced to the normal in two days. Similarly, in the case of a dog in which the quantity of the blood was much increased by transfusion, the number of red corpuscles in the cubic millmetre of blood was found to be greatly in excess thirty minutes after the experiment, but here again the polycythæmia was only transitory, disappearing some days after the transfusion, though of course less quickly than the artificial plethora did.

In no such experiments have the conditions prevailing in the various classes of polycythæmic polyæmia (plethoric polycythæmia) (plethora vera) of human beings been fulfilled. In all these cases in human beings the polycythæmia, as we have explained, arises from increased activity in the hæmopoietic functions of the bone-marrow, and the increased activity of the bone-marrow is in its results practically equivalent to a gradual persistent transfusion of blood into the vessels. In other words the bone-marrow in these cases is constantly engaged in producing excess of blood, and forcing all of it into the blood-stream. The increased total quantity and polycythæmic quality of the circulating blood are both therefore the natural result of the persistent increased formation of blood in the bone-marrow, and a similar condition of persistent polycythæmia would be obtained in Worm-Müller's experiments on animals, were it possible (which of course is not) to modify his experiments, so as to make the transfusion of blood a gradual persistent process, lasting,

not for a few minutes, but for days, weeks, months, and years.

I think I have now sufficiently explained what I believe to be the only tenable views regarding the origin of the various classes of true (absolute) polycythæmia. They are all due to an increased hæmopoietic activity of the bone-marrow, that is to say, they are all myelogenous in origin, but although the exciting cause of this increased functional activity is recognised, as I have already explained, in regard to the polycythæmia connected with disorders of the circulatory system and life at high altitudes, it remains unknown in regard to the so-called "splenomegalic polycythæmia." In this last class of polycythæmia the excessive functional activity of the bone-marrow constitutes as yet the primary recognisable morbid factor, and that is the reason why, in 1905,[1] I proposed the term "myelopathic" (not merely myelogenous or myelogenic) polycythæmia for it. The excessive formation of red blood-corpuscles in myelopathic polycythæmia may perhaps be regarded as analogous to the excessive formation of white blood-corpuscles in cases of leukæmia. It has likewise been explained as the result of a morphological and functional reversion to a past condition (normal in fœtal life and early life after birth) in which the bone-marrow of the shafts of the long bones is red and still actively engaged in the formation of erythrocytes, instead of being yellow and fatty as most of it is in healthy adults. If the analogy to leukæmia proves to be appropriate, the term "erythræmia" employed by W. Türk,[2] Hans Hirschfield,[3] and by Osler[4] will be obviously preferable to the term "myelopathic polycythæmia" and the various other names which have been proposed, since it implies that the disease is one which in regard to erythrocyte-formation is analogous to leukæmia in regard to leucocyte-formation.[5]

[1] *Medico-Chirurgical Transactions*, London, 1905, Vol. LXXXVIII., p. 191.

[2] *Wiener klin. Wochenschrift*, 1904, No. 7, p. 192.

[3] *Berliner klin. Wochenschrift*, October 14th, 1907, p. 1302.

[4] *Lancet*, January 18th, 1908, p. 143.

[5] For possible objections to this view see J. Bence, *Deut. med. Wochenschrift*, 1906, No. 37, p. 1497, and F. Lommel, *Münchener med. Wochenschrift*, 1908, No. 6, p. 272. According to Bence, the polycythæmia of the so-called splenomegalic polycythæmia can be diminished by oxygenation-inhalation just as he claims that the polycythæmia of cardiac origin and that due to high altitudes can be. I suppose that in all such investigations the method of oxygen-inhalation employed would be such as effectually to increase the oxygen-tension in the inspired air.

The word "erythrocytosis" could then, as Hirschfield advises, be reserved for any "reactive" increase in the number of erythrocytes (such as the polycythæmia of cardiac insufficiency, and the polycythæmia of high altitudes) resulting from imperfect oxygenation of the blood and tissues of the body, just as the word "leucocytosis" is now limited to signify a "reactive" increase in the number of leucocytes, such as that resulting from (and as a reaction towards) streptococcal and other microbic invasions of the body.

The Relation of Polycythæmia to Blood-Viscosity.—The blood-viscosity is always raised when the number of red corpuscles per cubic millimetre of blood is much increased. This can be demonstrated, as I have myself found, in specimens of blood from patients with polycythæmia and chronic cyanosis of cardiac or pulmonary origin. So also in two cases of splenomegalic polycythæmia I found the viscosity of citrated specimens of the venesection-blood to be more than twice the normal. Supposing the viscosity of normal human blood to be about 5·3, that is to say, 5·3 times that of water (when the temperature of both is 38° C.), Lommel found the viscosity to be over 11·0 in one case of splenomegalic polycythæmia, whilst Bence in another case obtained figures varying from 15·9 to 20·9. In three cases of cyanosis in heart disease, and in one case of bronchitis with emphysema, Bence obtained viscosity-values of between 6·9 and 8·2. In some rough experiments made in 1904 with J. H. Watson on citrated horse's blood, we showed that the variations in viscosity generally depended mainly, though of course not entirely, on the proportion of the blood-corpuscles to the volume of blood-plasma. It was found, for instance, that horse's blood-plasma, artificially mixed with two millions of red corpuscles to the cubic millimetre, took 84 seconds to pass through the bulb of the "viscosity-tube," whilst a sample containing four million red corpuscles to the cubic millimetre took 110 seconds to pass through the bulb of the same tube.[1] There can be no doubt that blood-viscosity is of some importance in regard to the question of venesection in chronic diseases of the heart and lungs, since in cases of cyanosis with polycythæmia, increased blood-viscosity, and engorgement of the right side of the heart, venesection must

[1] *Clinical Society's Transactions*, London, 1904, Vol. 37, p. 130.

not only temporarily relieve the right side of the heart, but must also, by diluting the blood,[1] reduce its viscosity, and thus enable it to circulate more freely through the capillaries of the lungs and other organs. I believe that Determann's viscosimeter is one of the most convenient instruments at present to be obtained for clinically examining the viscosity of the blood. Only a very small sample of blood is required, no more than can be readily obtained by pricking the lobe of the ear. Coagulation is prevented by the use of "hirudin." The only drawback to Determann's method is that, according to his directions, the skin (that is, the lobe of the ear) may not be washed and thoroughly disinfected just before the puncture is made; but this objection should apply just as much to all "clinical viscosimeters" in which only a very small sample of blood is employed for estimating the viscosity.

There can be little doubt that in some individuals a condition of polycythæmia is produced (*i.e.*, as a vital reaction against deficient oxygenation of the blood and tissues) more easily than in others. Moreover, patients with chronic diseases of the heart and lungs, which ought to give rise to polycythæmia, may of course owing to special circumstances (that is to say, owing to factors other than imperfect oxygenation) be anæmic instead of polycythæmic. A practical result, however, of what I have explained in the present summary of the subject is that a person who is healthy except for some pulmonary or cardiac affection, which mechanically hinders normal oxygenation of the blood and tissues, should be expected to have blood differing in quality from that of a completely healthy person by its more or less greater richness in red corpuscles. This, I believe, is the chief reason why persons with incipient or old quiescent pulmonary tuberculosis, when well fed and otherwise properly treated in sanatoriums, often show a moderate degree of polycythæmia when a blood count is taken.

[1] Some of the blood withdrawn by ordinary venesection from the blood-vessels is of course quickly replaced by water and salts absorbed from the alimentary canal, and thus venesection rapidly causes dilution of the circulating blood.

INJURIES TO THE HEAD IN YOUNG CHILDREN.

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[With Plate X.]

These injuries present many interesting features, and differ materially from similar injuries met with in later years. Anatomical conditions explain these differences, the infant's skull is less resisting and the bones are flexible; the dura mater is more intimately adherent to the bone; the sutures are ununited, so that movement is permitted between the bones.

The effect of force applied to the skull is well illustrated during birth, yet fractures rarely occur, and when they are met with, they usually result from some abnormality of the pelvis, such as flattening or undue prominence of the sacrum, or great disproportion between the size of the presenting head and the bony ring through which it has to pass. Precipitate labour, or the application of forceps occasionally causes fracture or depression of the bone, but, in many cases, it is not the forceps that actually causes the damage, but the traction made on them causing pressure of the head against the sacral promontory. Depressions may vary in degree, the slighter cases show some flattening or dinting, which gradually disappears, or at least becomes less marked and requires no treatment. On the other hand, if the depression is severe, treatment by operation may be required. In a certain number of these cases, the depression may cause death, but it is more often that the child is still-born from the protracted labour, produced by the conditions enumerated above. Schroder reported 65 cases, 22 were still-born and 10 died from the injury. The following case, upon which I was called upon to operate, is a good example of an extreme injury of this class :—

A baby, one week old, was admitted into the North-Eastern Hospital for Children, with a spoon-shaped depression of the left frontal bone. Forceps had been used in delivery, and may actually have caused it. It was quite obvious that such a condition would not right itself, so I reflected

a flap of scalp from around the periphery of the depression, and endeavoured to spring the bone back into position by insinuating a periosteal elevator between it and the dura mater, but this manœuvre failing in its object, I divided the bone down the middle with scissors, after separating the underlying dura, and made several lateral incisions on each side; this enabled me to replace the bone in position quite easily. As soon as the pressure of the bone was taken off, the brain pushed the dura up to the level of the replaced bone. The colour of the dura was normal, indicating that no hæmorrhage existed beneath it to necessitate opening it. The baby made a satisfactory recovery, and there was practically no deformity.

Reverting to the anatomical conditions already mentioned, when fractures are met with in young infants, owing to the softness and flexibility of the bone, the injury to it is more localised than in the adult, and the cranial bones not being united, the fracture does not extend along the line of the sutures from the vertex into the base; however, it must not be forgotten that injury to the brain is liable to be quite out of proportion to the damage to the skull, and although this is the case the symptoms are usually slight even when the brain is severely damaged. Moreover, the risk of the dura being torn is greater in the child, owing to its intimate attachment to the bone. If this occurs, the subdural space is opened up, and the cerebro-spinal fluid escapes, with the result that a cephalhydrocele may form.

As an interesting example of this class of injury, I will relate the following case:—

A baby, aged six weeks. A few hours before admission to the hospital the infant fell off a bed on to its head. At the time of admission, it was found to have a large swelling over the right side of its head. The tumour, which was limited to the right parietal bone, gradually increased in size, and there was a distinct impulse in it when the child cried. During the first two days, twitching was noticed in the left arm and leg; there was no loss of consciousness after the injury. On pressing through the swelling, a horizontal gap could be felt in the bone, and this gradually increased in size until, on the sixteenth day after the accident, it was fully half an inch in width.

Owing to the unfavourable prognosis in these cases, in which the tumour steadily increases, I determined to treat it by operation, with the view of closing the rent in the dura, and drawing the bones together with a silver wire suture, and thus to close the gap. The operation was performed on the sixteenth day. A large flap of scalp was turned down off the tumour and the sac opened, the fluid was found to be lying beneath the separated periosteum, which formed the wall of the sac. The escape of the fluid was followed by such profound shock that the operation had to be completed with the greatest expedition. A fracture, one and a half inches long, situated horizontally in the centre of the parietal bone, was exposed, the edges of the bone

being widely separated, and through the centre of the opening a hernia cerebri protruded. As the condition of the child admitted of no delay, I had to abandon the idea of defining and suturing the edges of the dura. The gap in the bone was closed by a stout silver wire suture, and the hernia cerebri cut away. The periosteum was replaced and sutured, and the scalp wound closed. After the operation the infant soon recovered from the shock, and no unfavourable symptoms ensued beyond slight rigidity of the left arm, nystagmus, and deviation of the eyes to the right, all of which disappeared in four days. Some months later I exhibited the child at the Clinical Society, when the opening in the bone was not quite closed, and a slight impulse was present when the child cried, but otherwise there was no bulging.

The conditions necessary for the formation of a cephal-hydrocele are a fracture with laceration of the dura. If the periosteum remains untorn, as is usually the case, the tumour is limited by the attachments of the periosteum at the periphery of the bone (usually the parietal); on the other hand, if the periosteum is also lacerated, the fluid escapes beneath the pericranial aponeurosis. The lacerated dura becomes adherent to the margin of the aperture, and the sac communicates with the arachnoid, or, in some cases where the brain is injured, directly with the ventricle. In the case recorded above, I was unable to determine this point owing to the child's condition, but I did not observe any opening in the protruded portion of the brain. In these cases, the aperture in the bone, which at first is very little more than a fissure, rapidly widens, this is in part due to separation of the fissure, and partly to the absorption of the edges of the bone. The treatment to be adopted will depend upon whether the tumour is stationary, or whether increasing in size. In the former case, it is doubtless safer to leave it alone or to apply gentle pressure. Cases have been recorded in which spontaneous cure has resulted. On the other hand, if the tumour is increasing, particularly if it occurs in a young infant, the prognosis is very unfavourable, and more active treatment may be deemed advisable.

The usual treatment has been repeated tappings, and the application of pressure, but the results have not been satisfactory, meningitis or hydrocephalus supervening in many cases. Whatever method of treatment is adopted, the outlook cannot be considered bright. At the present time, doubtless, operation would be favoured, but if it were possible to

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Fig. 1.—*Cephalhydrocele of 14 days' duration.*

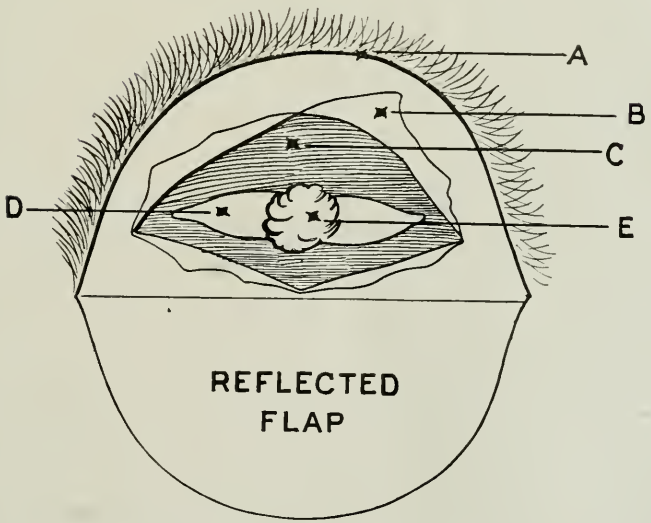

Fig. 2.—*Diagram of the operation.*

A. *Incision.* B. *Periosteum (reflected) forming sac.* C. *Bone.* D. *Dura.* E. *Hernia cerebri.*

collect a series of cases so treated, death from shock would, I fear, figure very prominently, if my own case can be taken as a criterion. February 11th, 1908.—The child was brought up for examination; it is bright and intelligent; there is no paresis or other sign of cerebral mischief. The cleft in the bone still remains about half an inch in width, but there is no bulging—only a slight impulse when the child cries. With regard to the operation, the following points are worthy of attention; in a similar case I should draw off the fluid an hour before the operation, and apply pressure in the hope that this would diminish the tendency to shock. In the case under notice, the sac, which was formed by the periosteum, was replaced and sutured, it would be an improvement to cut the sac away. In a young child there is no difficulty in drawing the bones together by a silver wire suture. I found one suture sufficient for the purpose, but where the condition is met with in an older child this would not be possible; in such a case the aperture might be closed by an osteoplastic section.

The diagnosis of tumours on the head usually presents no great difficulty. A convenient way of classifying them is into pulsatile and non-pulsatile, translucent and opaque. The pulsatile group include congenital encephalocele, and meningocele and cephalhydrocele, and some cases of chronic abscess, in which the bone is perforated. The filling of a venous nævus with blood, after it has been emptied by pressure, will hardly be mistaken for the pulsation of the above tumours. The non-pulsatile tumours include cephalhæmatoma, dermoids, and chronic abscess. Meningocele is the chief of the translucent tumours, but occasionally both a dermoid and a cephalhydrocele may be so.

The commonest injury of the head in the newly-born or young infant is hæmatoma; this must not be mistaken for the caput succedanum, with which it is frequently associated, and which disappears shortly after birth. Cephalhæmatoma situated beneath the periosteum usually takes some weeks to absorb. It must be remembered that a cephalhæmatoma may be associated with a depression of the bone or fracture, and that these conditions may be obscured by it. The important point is the question whether there is a depression of the

bone. A common error is to mistake a hæmatoma for a depressed fracture, owing to the fact that at the periphery of the swelling a bony ring can be felt. This arises from ossification taking place at the edge of the separated periosteum, and as a consequence it is raised above the surrounding surface of the skull, while, if it were a depressed fracture, the bone at the periphery of the depression would not present this feature. In the other varieties of cephalhæmatoma, the effused blood may lie beneath the aponeurosis, or the hæmorrhage may be situated within the skull, either between the bone and the dura, or within the dura over the surface of the brain; in these cases there may be no symptoms, but in the meningeal variety, if the hæmorrhage is severe, convulsions or paralysis ensue, and a considerable portion of such cases will have a fatal termination.

Hæmatomata usually require no active treatment, as absorption gradually takes place. The following case may be instanced, as operative treatment was considered advisable, and it was found that the hæmatoma was associated with a fissure, but the latter was unsuspected until the operation demonstrated its presence.

An infant, of 20 months, was admitted to the hospital with a large fluctuating swelling over the right parietal bone. The following history was obtained: six weeks previously it fell off a chair, striking its head, and was picked up unconscious, "limp and black in the face." The child rapidly regained consciousness, but "was queer for a few days," and, since the accident, had been exceptionally "cross," but no swelling had been noticed on the head until four days before it was brought to the hospital. The swelling extended over the greater part of the surface of the parietal bone, and the bony ring around its margin was well marked, so that I had no hesitation in differing from the opinion that had been formed that the case was one of a depressed fracture. As the swelling undoubtedly dated from the accident, I thought it desirable to evacuate the blood by operation. This was done, a quantity of dark blood clot being cleared away. On careful inspection of the bone, a single horizontal fissured fracture was found running right across the middle of the bone, and a little blood exuded from the crack. There was no depression of the bone or separation of the edges of the fracture, and, in the absence of cerebral symptoms, I did not consider it necessary to explore the interior of the skull. The child made an uneventful recovery.

It is impossible to estimate the frequency of fissured fractures in children; the symptoms may be slight and transitory, and from the nature of the injury physical signs are absent, so

that only those cases, in which the injury is sufficient to cause death, are discovered. If it were necessary to operate on all cases of hæmatoma, it is more than probable that a fissured fracture would be found associated in quite a large proportion.

Occasionally the blood may be effused so rapidly that the pressure threatens the overlying scalp, in such a case it might be necessary to withdraw or evacuate the blood. In the case under notice, it is probable that some cortical hæmorrhage occurred at the time of the injury, as the child was severely concussed, and afterwards showed signs of cerebral irritability.

Before leaving the subject, it should be mentioned that dermoids and caries of the skull may be mistaken for subperiosteal hæmatoma. A dermoid often produces an indentation of the bone, and, in some cases, it may actually lie partly beneath the bone, while, in caries from congenital syphilis or tubercle, an abscess may form and be associated with pitting of the bone from its destruction. I have recently operated on a case of tuberculous caries and abscess, which was situated above the external angle of the frontal bone, a position often occupied by a dermoid, and, although the swelling closely simulated a dermoid, the history and the presence of tubercle in other regions simplified the diagnosis. The bone was found extensively diseased, and the abscess extended beneath it over the surface of the dura.

Cases II. and III. are also of interest, as they demonstrate that a comparatively small amount of force may cause a fracture of the skull (both fell off a bed). The severity of the injury is doubtless due to the inability of an infant to protect itself in falling.

THE IMPORTANCE OF ACCURATE DIAGNOSIS AND THE TREATMENT OF FRACTURES IN THE VICINITY OF JOINTS.[1]

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At the time of an accident, correct diagnosis is often impossible, for, owing to the very marked displacement of the fragments of the long bones, the laceration of the soft parts, and consequent swelling, are frequently extreme; further, it is my impression that, with such fractures, mobility is decreased rather than increased, so that at first the diagnosis of dislocation rather than of fracture suggests itself. This immobility is most marked in those fractures, or rather splits, which sometimes extend from a joint surface into the shaft of a bone—as is, perhaps, most common at the lower end of the humerus—and is, in the early stages, no doubt due to hæmorrhage into the joint, and later on to the formation of callus or organised blood clot, which in this position interferes with the reception of the processes of the ulna in the fossæ of the lower end of the humerus. I should like to suggest that one of the causes of persistent immobility of a joint, after an injury taken to be a sprain, may not infrequently be an unsuspected fracture, often merely a fissure, extending into the joint cavity, which neither manipulation nor radiography is likely to disclose, but which I have twice seen at a subsequent operation.

It is unnecessary for me to detail the different physical signs, distinguishing such a fracture from a dislocation, but I should like to draw attention to the frequency with which, in certain positions, the two lesions are associated. Recently Robert Jones, of Liverpool, has drawn attention to those fractures of the neck of the scapula, or of the upper end of the humerus, which may complicate a dislocated shoulder, and has recorded sixteen fractures of the surgical neck of the humerus in 200 consecutive radiographic examinations of dislocations of this joint.

[1] Read before the Norwood branch of the British Medical Association.

In the same connection, we must remember that a variable amount of displacement of the foot backwards is a necessary result of one of the forms of Pott's fracture, that its correction is one of the most tedious features of the treatment, and that its persistence must prevent the restoration of a useful limb to the patient.

In a child, the character of the crepitus and the exact position of the level of the injury will usually enable us to discern between a fracture and a separation of the epiphysis; but it is well to regard all fractures, near an epiphysial line, as actual separations, and to prognose accordingly, for it is frequently found that an oblique fracture will run down to the epiphysial line, and will then be continued along it with a similar effect upon the growth of the bone, which a complete epiphysial separation usually produces.

For the purposes of classification, we may follow Watson Cheyne (*Clin. Journal*, May, 1907) in dividing these fractures into three forms :—

1. Those which do not involve the articular ends of the bone, and are usually outside the capsule, though this may be torn to a variable degree. These are common at the base of the neck of the femur, and at both extremities of the humerus ; if transverse, but little deformity ensues, but if, as is common at the lower end of the humerus, the line of fracture is oblique, the overlapping of the fragments may be considerable, and their maintenance afterwards in a good position will be a matter of the greatest difficulty.

2. Fractures extending into the joint cavity, either as a linear split involving one of the condyles of the humerus, or as a T-shaped fracture or comminution of the articular extremity. While these do not usually produce much antero-posterior deformity, they often markedly alter the carrying angle at the elbow when the lower end of the humerus is the bone involved, and in fact attention to this physical sign may alone guide one to a correct diagnosis.

3. Fractures not extending into joints, but which are typically associated with some displacement of the adjacent articular surfaces; Colles' fracture, or Pott's fracture, mentioned above, are common examples of this form.

If attention is paid to the outline of the injured part, if,

in the absence of much swelling, accurate measurements are taken for comparison with the uninjured limb, and if a careful digital examination of the bony processes on the two sides is made, and their relations are compared, a definite diagnosis of fracture, or at least of its probability, is usually possible; the supposition can now be confirmed by the X-rays, but while I am, I trust, fully alive to the value of X-rays in the diagnosis and treatment of fractures, I must venture to protest against the growing tendency to regard the taking of an X-ray photograph as the one and only matter of value or importance in the diagnosis of fracture in any part of the body; such a tendency among students can only paralyse the cultivation of powers of observation for later emergencies, and leaves those, who rely solely upon radiography, hopelessly stranded, when, as must often happen, they are called upon suddenly to deal with a fracture unaided by X-rays.

In the treatment of these injuries, the first thing to be done is to reduce the deformity should any exist, and here an ideal method is to carry out this procedure on the X-ray couch with the patient under a general anæsthetic, so that it may be ascertained, not only that the deformity has been reduced, but that this reduction is maintained after the splint or other retaining apparatus has been applied. If this ideal is not attainable, an X-ray picture should be taken before and after the application of the splint. With regard to the different manipulations necessary for the reduction of the deformity, I cannot say much; in fractures near the head of the humerus, traction with extension and abduction will be best; at the lower end of the humerus complete flexion and fixation in this position will give the best result (as I think Robert Jones first pointed out). Similarly in fractures of the lower end of the femur, flexion is most valuable, which can be maintained by the use of a Macintyre's splint. It is of the utmost importance that reduction of the deformity, and the putting up of the fracture should be undertaken as soon as possible after the injury has occurred, and that, if this is unsatisfactory, immediate steps should be taken to correct it, for we must not allow ourselves to believe that further relaxation of the muscles will take place, and that the displacement will correct itself; it is far more likely to relapse.

The chief obstacle to reposition of the fragments, whether by manipulation or by operation, is the small size of the articular fragment, and the movements carried out must be those which will bring the rough end of the large fragment into contact with the displaced end of the small articular fragment. If this can be done, the deformity will not be reproduced in the majority of cases, and this is especially true of transverse fractures, for muscular tension, aided by a splint, holds the parts in contact, and a fair result is obtained.

Should manipulation fail to produce the desired result, or, having produced it, should it be found impossible to maintain the fragments in apposition, then there is no alternative but recourse to an open operation; and whatever opinion we may hold as to the desirability of advising operative reduction and fixation of fractures of the shafts of the long bones, we must allow that this may be often necessary in the case of fractures near joints because of the deformity and mechanical depreciation which a badly-united fracture in such a position may produce.

In the aged, very stout, or those who, from alcoholic habits, or bodily disease, are unsuited for surgical interference, we may be content with a result which cannot be the best possible, otherwise it is at the present time our duty to put before these patients the possibility of obtaining a better limb by a recourse to surgery.

I should like to endorse the opinion of others of greater experience than my own that the best result can only be obtained by surgery, when operation is undertaken shortly after the accident. It is far easier to replace the fragments, and to secure them in good position in a recent case than after partial or complete union has taken place in a bad position. At present an unfortunately large percentage of the cases coming into the surgeon's hands are splint failures, and the results are correspondingly unsatisfactory. Some advise operation within two or three days of the accident, though, for my own part, I prefer to wait for 5 to 10 days to allow swelling to subside, and for the skin to be prepared.

If the fracture is compound, no operation must be undertaken until the wounds are clean and beginning to heal.

In the fractures we are discussing, operation gives an

additional advantage, in that it enables us to remove blood-clot around the fragments or in the joint, and so, in some measure, to prevent the formation of an organised mass which may interfere with movement. In several positions, *e.g.*, as in a fracture of the lower end of the humerus, reduction is all that is necessary, for after this has been effected the fragments will usually remain in a good position, so that the introduction of wire, screws, or plates is often unnecessary. Massage may be begun after three or four days, and passive movements in eight or ten days. Should some retaining device be necessary, the suitability of wire, screws, or Arbuthnot Lane's steel plates must be decided upon the individual requirements of each case. Operation for an old ununited or mal-united fracture is always a very difficult matter, and, if the overlapping has resulted in shortening of the muscles, removal of some bone is usually necessary in order to get the ends in fair apposition.

In fractures complicated by dislocation, unless recent, excision of the articular extremity is frequently necessary, and this I have found in the region of the shoulder or the elbow leads to a good functional result. Similarly skiagrams have been taken of a carpus from which I removed half of a fractured scaphoid, and obtained good movement. Previous to operation, a large mass of callus and the displaced fragment had much interfered with the necessary movements of the wrist.

In conclusion, let us not forget that we must attempt to secure, not only the replacement of the normal outline of the bone, but also a perfect restoration of the movements of the adjacent joint and of the muscles, unhindered by any organised adhesions; so we must beware of estimating our success by perhaps a single X-ray picture taken in the most favourable plane which, even if it shows the normal outline of the bone perfectly restored, tells us nothing of the functional result, as the movements of the joint may be impaired, and the adjacent tendons may be adherent.

THE RELATION BETWEEN SCIATICA AND DISEASE OF THE HIP-JOINT.

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[With Plates XI.—XVI.]

THE clinical evidence in support of the view that the origin of the pain in sciatica is in the hip-joint was very thoroughly discussed three years ago by Dr. William Bruce in an address on the Real Nature and Rational Treatment of this disease.[1] This theory, probable as it was, could not be expected to immediately destroy the time-honoured belief that sciatica is a neuritis. It can be readily understood, that, without pathological evidence, which in these cases is so difficult to obtain, most physicians would hesitate to accept the new proposition. The sciatica referred to must be understood as excluding examples of sciatica due to manifest spinal disease or to pressure from tumours in the pelvis.

In order to obtain such evidence, with a view to demonstrating the truth or otherwise of Dr. Bruce's contention, I have taken from time to time, as opportunity offered, radiograms of the hip-joint in cases of sciatica. Briefly I may say that, in most of the cases offering typical symptoms of old standing sciatica, I have found demonstrable changes in the joint.

It must be remembered, however, that the X-ray shadow of the head of the femur and acetabulum being in profile, a radiogram will only show changes in the outline if these changes are present at the upper or lower aspects of the joint. Changes in the anterior or posterior aspects of the joint, if not extending to the upper or lower parts, would therefore not be recognised by this method of examination. In early cases also, when the changes are confined to some inflammatory thickening in the synovial membrane, or to slight deposits of calcareous material or uric acid salts, the alteration in the structure of the joint might be so slight, that a radiogram would not clearly demonstrate it. Thus a certain number of cases submitted to examination (early cases of arthritis, or

[1] "Sciatica: An Inquiry as to its Real Nature and Rational Treatment." *Lancet*, August 1903.

those cases in which the alterations in the structure of the joint are slight) would not offer clear evidence of an arthritis, which may still, however, be present.

In order to demonstrate the excellent evidence of chronic arthritis which may be obtained by the use of the Roentgen rays, I wish to draw your attention to a radiogram of the hip-joint of a woman aged 35 (Fig. 1, Plate XI.). The case is one of arthritis deformans which had presented difficulties in diagnosis.

The radiogram (Fig. 1) is the joint on the unaffected side, and the radiogram (Fig. 2, Plate XI.) is the diseased joint. If one is compared with the other, in the radiogram (Fig. 2) there is an appearance of translucency over the head and upper part of the neck of femur, which is limited externally by a sharply defined circular margin. This appearance is often seen in similar cases ; the diminution of normal opacity is due to rarefaction of bone. There is marked lipping of the acetabulum, and the shortening and thickening of the neck of the femur are well seen. Surrounding the joint there is a certain amount of opacity, which may be accounted for by supposing that there is some infiltration of the capsule and ligaments, opaque to the rays.

Arthritis of gouty origin may often be demonstrated by the aid of the X-ray.[1]

Thus it will be seen that chronic arthritis in a deep-seated joint, such as the hip, may be demonstrated in a radiogram, and that gouty as well as other chronic inflammations may be discovered in this way.

The method that I employ in radiographing all joints, is to use what may be termed a fixed position, that is, in the case of a given joint, the patient is always placed in the same position on the couch, and by means of a mechanical contrivance of my own. The Crooke's tube, in a box under the couch, is so arranged that it can be instantly adjusted to the same relative position immediately beneath the joint, and at the same distance from the structures which are being radiographed. The advantage of a method such as this is very great. Apart from the uniformity of results obtained, one is able by com-

[1] Extra Number of THE PRACTITIONER on "X-Rays in Diagnosis," Plate XV., Fig. 2.

4.5.6

PLATE XI.

Fig. 1.—*Arthritis Deformans. Normal joint.*

Fig. 2.—*Arthritis Deformans. Affected joint.*

Fig. 3.—*Case of T. L. Normal joint.*

Fig. 4.—*Case of T. L. Affected joint.*

parison with a radiogram of a normal joint, which has also been taken in what I call the fixed position, to see at a glance, where, and to what extent the structures of the joint, one is examining, show a departure from the normal.

Let me now draw attention to the cases of sciatica which I have collected, and in which I have discovered an associated arthritis of the corresponding hip-joint. I have had the opportunity of examining twelve cases presenting typical symptoms of sciatica, and of these I have selected five, in which there will be no difficulty in observing the articular changes which have taken place. But before giving the details of these cases I should like to quote from Allbutt's *System of Medicine*[1] a short description of the symptoms of sciatica, in order to show that the clinical picture of sciatica is faithfully reproduced in the history given of these patients :—

"The great symptom is pain, it may come on gradually tending to increase and to get worse on muscular effort, on pressure over the nerve trunk and often towards night. The pain may come on suddenly and may or may not be paroxysmal in character. Eventually even the slightest movement may be accompanied by pain. Walking may only be possible with the knee bent. The pain is often burning or gnawing, and may be constant or may at times increase in severity. Pain is also specially referred to the following regions. The sciatic notch, the middle of the thigh, above the hip-joint, the popliteal space, behind the external malleolus and the dorsum of the foot. In protracted cases, groups of muscles may waste. Numbness, tingling and formication are not uncommon, and sometimes areas of complete anæsthesia are present."

First Case.—The first case is that of a man, aged 56, admitted into Charing Cross Hospital under Dr. Abercrombie. He worked as a boiler stoker in a large hotel, and came into the hospital complaining of pain in the left leg, which prevented him from working, and which he described as a burning shooting pain affecting the whole limb, but particularly the posterior aspect. It was sufficient at times to prevent him from sleeping at night. The pain gradually got worse

[1] Allbutt's *System of Medicine*, Vol. VI., p. 663.

and was always worse at night. He could not turn in bed, and even the weight of the bedclothes caused him distress. He said that the only way in which he could get relief from the pain for some time before he came into hospital was to walk with a weight in his left hand. The pain was felt on the surface of the limb over the gluteal region, down the posterior aspect of the thigh, and along the posterior and outer aspect of the leg as far as the ankle-joint. When he was admitted, a diagnosis of sciatica was made and treatment for this complaint was carried out.

On examination, the muscles of the gluteal region and thigh were found to be wasted, the patient walked with some eversion of the foot and was distinctly lame. Passive movements of the hip-joint were free, but semi-flexion with rotation inwards and extreme flexion were accompanied by pain. Pressure over the sciatic notch and in the popliteal space gave acute pain, as also did deep pressure over the head of the femur anteriorly.

Radiograms of both hip-joints were taken (Plate XII.). The radiogram (Fig. 3, Plate XII.) is the joint of the sound side. The outline of the bones forming the joint are clearly defined and offer a great contrast to the condition seen in the radiogram (Fig. 4, Plate XII.), which is the joint of the affected side. There is the same appearance of translucency, limited externally by a circular border, which is seen in the radiogram of the case of arthritis deformans (Fig. 2, Plate XI.). At the lower part of the outline of head of the bone, the normal rounded appearance has been replaced by opacities with an irregular outline. Along the upper outline of the joint another opacity is seen in a position corresponding with the margin of the acetabulum, indicating new deposits of bone or other material very opaque to the rays. The digital fossa instead of being clearly outlined is filled up with opaque material. Ultimately the condition of this patient, owing to the continued pain, was such as to justify excision of the head of the femur. This operation was carried out by Mr. P. Daniel at the Metropolitan Hospital, and the portion of bone removed shows those changes usually associated with arthritis deformans.

Second Case.—The second case is that of a man, aged 50, living in extremely good circumstances. He had frequently

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Fig. 5.—*Case of J. D. Normal joint.*

Fig. 6.—*Case of J. D. Affected joint.*

Fig. 7.—*Case of M. H. Normal joint.*

Fig. 8.—*Case of M. H. Affected joint.*

suffered from attacks of gout in his shoulder. Suddenly one night he was attacked with pain in the region of the right hip, which gradually spread down the whole of the back of the thigh and leg. He compared the character of the pain with toothache affecting the whole limb. While the acute pain lasted, he was quite unable to move even in bed ; he could not sleep, and was prostrated by the severity of the pain. Later, as the acute pain subsided, he was able to walk but with some difficulty. Standing about playing a game like croquet had the effect of greatly increasing the pain. The pain was always worse at night. As a rule he could best obtain relief by sitting down and raising his legs with his feet higher than his head.

On examination, there was found slight wasting of the muscles of the gluteal region and of the thigh. He walked with a distinct limp, keeping his knee bent. Pain was observed on pressure over the sciatic notch and in the popliteal space. No pain was caused by deep pressure over the head of the femur anteriorly. The movements of the joint were free. The pain was felt on the surface of the limb along the posterior and outer aspects of the thigh, and over the posterior, external and anterior aspects of the leg, as far as the ankle-joint. For the purpose of comparing normal with abnormal refer to the radiogram in Plate XIII. Fig. 5 (Plate XIII.) is that of the normal joint, and Fig. 6 (Plate XIII.) that of the affected joint. In Fig. 6 along the upper outline of the joint there is a sharp-pointed excrescence directed upwards from the head of the femur, which nearly reaches the edge of acetabulum (marked →). Opposed to this, from the edge of the acetabulum arises a slight projection of less opacity than the bone from which it springs. The apparent translucency of the outer part of the trochanter is a photographic phenomenon.

The *Third Case* is that of a charwoman, aged 62, who attended at the Charing Cross Hospital as an out-patient for electrical treatment for sciatica. She stated that she suffered at various times from rheumatic pain in the joints, and lately had been troubled with increasing pain and lameness of the right leg. These pains had been gradually increasing in severity for six months ; they were always worse after much standing ; they were worse at night, and often

prevented sleep; rest relieved the pains. She also stated that the limb was inclined to give way under her, and that the skin on the outer side of the leg occasionally felt numb.

On examination, the muscles of the gluteal region and thigh were found to be wasted. Pain was elicited on pressure over the sciatic notch, in the popliteal space, and also over the head of the femur anteriorly. The movements of the joint were quite free. The position where pain was felt was stated to be the posterior and outer aspects of the thigh, and the posterior and outer aspect of the leg below the knee. In this latter position the patient experienced the numbness previously alluded to, but no area of anæsthesia could be demonstrated.

The radiogram (Fig. 7, Plate XIV.) shows a normal hip-joint, while that of the affected joint (Fig. 8, Plate XIV.) shows an obliteration of definition of the normal outline of the head and neck of the femur. The digital fossa is filled up with some opaque material; and the capsule of the joint is apparently infiltrated with some form of deposit, which is opaque to the rays. There are evidently very considerable changes in the joint.

Fourth Case.—The next case is that of a woman, aged 32, who attended at the Charing Cross Hospital as an out-patient. She lives in fairly good circumstances, earning her living as a housekeeper. In her history she states that eight years ago she suffered from rheumatic fever. Since that illness she has been on several occasions laid up, for considerable periods, with attacks of acute pain affecting the whole of the right lower extremity. These attacks were diagnosed and treated as sciatica. The present trouble commenced with pain, which at first was felt at the inside of the knee, and afterwards in the hips and groin. The pain gradually increased in severity, and ultimately affected the whole limb. She describes the pain as being throbbing and neuralgic in character. For two years she has walked lame, and has had difficulty in turning in bed and in going upstairs. The pain is always worse at night.

On examination, the movements of the joint were found to be free, but semiflexion with rotation inwards gave pain. Pressure above the great trochanter, over the sciatic notch, and in the popliteal space, gave pain. The muscles of the

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Fig. 9.—*Case of Miss S. Normal joint.*

Fig. 10.—*Case of Miss. S. Affected joint.*

Plate XVI.

Fig. 11.—*Affected joint. Take* Fig. 7 (*Plate* XIV.) *as normal.*

gluteal region and of the thigh were wasted. The painful areas on the surface of the limb were the gluteal region, the posterior aspect of the thigh, and the outer and posterior aspect of the leg as far as the ankle.

By comparing the radiogram of the normal joint (Fig. 9, Plate XV.) with the radiogram of the joint on the affected side (Fig. 10, Plate XV.), it will be seen how striking are the changes which have taken place. The normal outline of the head and neck of the femur has disappeared, and is replaced by an irregular mass of opaque material. Above, this mass is sharply limited internally, where it meets the overgrown rim of the acetabulum. The lower outline of the joint is also deformed in the same way. Considerable disorganisation of the structures forming the joint has evidently taken place.

Fifth Case.—The last case is that of a man, aged 48, tall and well built, and very muscular. Whilst serving with the Imperial Yeomanry he was thrown from his horse, and falling upon his hip was seriously injured. The diagnosis made at the time was—a doubtful fracture. The accident confined him to bed, and he suffered at the time great pain in the hip. Ultimately he was able to get about, but always with pain and difficulty. The pain gradually became worse and extended down the whole of the posterior aspect of the limb. It was always worse at night, and often made sleep impossible. Lately he had complained of sensations of pins and needles. The pain was felt as far down as the heel. He said that he was treated for sciatica, and indeed his skin bore indisputable evidence of the accuracy of this statement. Massage and electrical treatment were also tried, but the pain continued to increase.

On examination, the patient walked with eversion of the foot; he was quite lame, and had to help himself along with a stick. There was marked wasting of the gluteal and thigh muscles. Pain was caused by pressure over the sciatic notch and over the head of the femur anteriorly. The pain was felt over the whole limb, but *principally* at the back of the thigh *and leg*.

On comparing the radiogram Plate XVI. (Fig. 11), which shows the condition of the affected joint with that of a

normal joint, as seen in Plate XIII., Fig. 5, it will be readily seen that extraordinary changes have taken place. There is a mass, of the same density as bone, overhanging the head of the femur and evidently arising from the direction of the rim of the acetabulum. Below there is a mass of bony material, most of which appears also to belong to the acetabulum. The neck of the femur is shortened and thickened, and the outlines of the bones are not as regular or as clearly defined as they should be. The radiogram is a good illustration of the changes that may take place in a joint as the result of injury.

It is admitted that tubercular disease of the hip-joint is frequently associated with pain, referred to, that is, felt over the internal aspect of the knee-joint, and in the knee-joint itself. The explanation of this being, that the obturator nerve, which supplies the ligamentum teres and the capsule of the hip-joint, also supplies branches to the knee-joint and to the skin over the inside of the knee. Hilton[1] suggests, indeed, that this is an indication that the ligamentum teres is the most common seat of early tubercular disease. In discussing this subject further, he says:—

"Now suppose the anterior part of the capsular ligament (which receives a branch from the anterior crural) is inflamed, applying the same law, you will see how it may happen that a patient with a diseased hip-joint, may have pain in the front of the knee, or on the inner side of the ankle, because the anterior crural sends branches to these particular spots. Or if the inflammation or injury begins at the posterior part of the capsular ligament which receives a branch or branches from the sacral plexus, then the patient may have a sympathetic pain actually at the heel, or in the foot."

In the same way it must be possible for hip-joint disease, other than tubercular, to initiate referred or sympathetic pains, which will be felt elsewhere. Diseases in this joint such as gout or arthritis deformans, may be the starting point of pains that can be present almost anywhere on the surface area of the affected limb, and thus give rise to conditions which are recognised as "sciatica," and treated accordingly.

One of the most constant signs in cases of sciatica is wasting of the muscles of the gluteal region. This should surely be an

[1] Hilton's *Rest and Pain.*

indication of disease of the hip-joint. The gluteal muscles are not supplied by the sciatic nerve, and if this disease is a neuritis of the sciatic nerve, and nothing else, the natural inquiry arises, why should these muscles waste ? I might also point to the want of evidence of a genuine neuritis in the sciatic nerve to the absence of electrical reaction of degeneration in the muscles, to the admittedly close relation between sciatica and the gouty and rheumatic diathesis, to the lameness present, and to the fact that the most successful treatment of the condition is absolute rest, which of necessity involves rest of the hip-joint itself. If the disease is a neuritis, why should this nerve, which is so well protected in its anatomical position by the muscles and tissues of the thigh, be so frequently attacked in comparison with such a nerve as the ulnar ?

All these and many other arguments could be advanced, but my purpose is to bring to your notice those cases which present the signs and symptoms which are usually recognised as sciatica. In all of them this diagnosis had been made independently ; and the usual treatment for the condition had been carried out. In each of them the radiogram shows disease of the hip-joint more or less extensive in its nature.

I do not wish it to be thought that I am making the assertion that all cases of chronic arthritis of the hip-joint are associated with sciatica. Chronic arthritis of the hip-joint is a condition well known and quite frequently met with ; it would, however, be much more frequently recognised in its early stages were it not for the deep-seated position of the joint, and the difficulty of applying the ordinary methods of examination in it.

Many cases of sciatica, after many years of suffering on the part of the patient, become quite chronic in their nature, and when changes in the hip-joint become obvious, and still more so, when ankylosis has been established, the case is removed from the category of sciatica, and is set down as arthritis deformans.

In conclusion, I think that it may be fairly stated that, if systematic examination of the hip-joint by X-rays, in intractable cases of sciatica, were carried out, it would be found, in many of the cases, that the sciatica was present as a symptom only of disease of the hip-joint.

SOME IMPORTANT POINTS IN CONNECTION WITH INFANT FEEDING.

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The subject of infant feeding is one about which much has been written, but, in spite of the numberless books and papers which have appeared from time to time dealing with this question, we find that many medical men are still not a little at sea when they are face to face with such cases as call for treatment by feeding merely. We shall, therefore, endeavour to direct special attention to mistakes commonly made, and fallacies still implicitly given credence to, by those who ought to know better.

In the first place, we must assume that mother's milk is the only correct form of nourishment for the infant during the first nine or ten months of its existence. Any substitute for this must never be looked upon as entirely satisfactory. The best substitute for breast-milk, however, is cow's milk suitably diluted. The common mistake made by the majority of practitioners is to order complicated milk mixtures. Some go in for diluting the milk with barley water, while others add lime water or a mixture of sugar and water. All this is really unnecessary, and only leads to troublesome complications in the preparation of the infant's food. The simpler the milk mixture is, the more likely is the patient to thrive on it. I have always advocated the use of a plain milk and water mixture, the milk being brought just short of the boiling point before the water is added. In certain cases a small amount of cream may be given in addition. This scalded milk is undoubtedly much more easily digested than milk which has not been so treated.

Sterilised milk, however, I have always regarded as a danger. I have never yet seen a child who throve on such milk. True, it may gain weight; but, as I shall have to point out, this gain in weight, of which many people make so much, is very often extremely fallacious and misleading.

My experience is that infants reared on sterilised milk rapidly become anæmic. They suffer from constipation, and are more than ordinarily liable to display evidences of rickets or of scorbutus. It must be remembered, too, that in many instances sterilised milk contains as many bacteria as, if not more than, untreated milk, for the simple reason that less care has been taken in the handling of it. Cases of diarrhœa do present themselves, although the patients are fed entirely on sterilised milk. In some cases, I feel sure this is due to want of care on the part of the parent or nurse, but I have, personally, found infants affected with diarrhœa who were being fed on sterilised milk with the utmost care and attention as to the mode of feeding. In such cases, I can only believe that the milk was already infected.

While on the question of sterilised milk, I must protest against the management of milk depôts by nurses and laymen. If they are to exist at all they must be under the immediate control of a medical man, and one who is thoroughly imbued with the superiority of breast-feeding over all other methods. Time after time I have come across women who have given up nursing because they thought the "depôt milk" was the most up-to-date mode of infant feeding. When a woman applies for sterilised milk, the medical man, who has charge of the depôt, ought first of all to ascertain whether or not the mother is able to nurse her child. If she is, then she should be advised to continue breast-feeding. One sometimes finds even medical men advising mothers to wean their infants, because the latter do not appear to be thriving. Careful inquiry in such cases will often reveal the fact that the real cause of the infant's want of progress is not in the breast milk, but in the careless and haphazard method of feeding the baby. Regular nursing is a *sine quâ non* to success, and this fact is one which must be strongly impressed on the minds of mothers.

Sterilised milk, as supplied at the various milk depôts, is not always everything that can be desired; but in some places this milk is resupplied to branches, and in this way the milk is carried about from place to place, churned up by the process, and passed through many different hands, until the absolute cleanliness of the containers is bound to become a

matter of great doubt. I have been told that in some depôts the milk left over from one day is sold on the next, and this I consider to be a most reprehensible and dangerous practice. To put it briefly, infant milk depôts require the strictest possible care in their management, and must be under the immediate supervision of an experienced medical man.

Sterilised milk, after all, is not the solution of the great infantile mortality problem. This can only be solved when the mothers of this and other countries are carefully instructed in the proper method to be adopted in breast-feeding. Few women know how to nurse their offspring, and thousands of infants are taken off the breast for no valid reason, and that, too, in many cases at the suggestion of the medical attendant. If breast-feeding is out of the question, then cow's milk must be tried. Pure cow's milk is devoid of all risks, and is not more likely to cause diarrhœa, if it is carefully handled from the time it leaves the udder of the cow, than average breast milk is. A great deal of nonsense has been written regarding the advantages of sterilised milk, and much time and energy have been needlessly expended in elaborating processes for the production of absolutely pure and germ-free milk. Milk, which has been "treated" by sterilisation or otherwise, is no longer cow's milk, but a fluid of somewhat similar composition devoid of the properties which are essential to the growth and proper development of the infant reared on it.

I have known infants, who had been having sterilised milk from a depôt, go steadily downhill, and begin at once to pick up when they were put on ordinary untreated milk. I have also records of infants fed on sterilised milk, who have been brought to me suffering from anæmia, constipation, scorbutus, and rickets. Such children are often late in walking. late in cutting their teeth, and are usually soft and flabby, with pale, unhealthy-looking skins. Some of these infants had actually been gaining weight. This brings me to the consideration of the value to be put upon the weight of the infant. Too much, I think, is made of gain in weight. Loss of weight, of course, is always significant, but gain in weight does not necessarily indicate gain in health and strength. Infants may readily enough put on a quantity of inert and flabby tissue which lacks tone. This added weight does not,

therefore, mean progress in development. Such infants may be the subjects of severe rickets, but the medical attendant is misled into the belief that the child is thriving simply because there is a regular gain in weight. The sooner this fallacy is prominently kept before us in practice the better will it be for all concerned. Personally, I attach little importance to the fact that a child is under weight, provided he is healthy. An infant of, say, six months may weigh no more than the average infant of three months, and yet he may be absolutely healthy in all respects. Loss of weight, however, is a very valuable index of retrogression. To put it briefly, the practitioner who trusts to gain in weight in estimating the progress or otherwise of his infant patients, while neglecting to observe the state of their muscles, blood, and general vitality, is very apt to be misled in the majority of cases.

One is apt to suppose that the dangers of artificial foods are well known to the profession. I am inclined to believe, however, that many medical men still continue to prescribe them. I am not going to condemn infant foods because they are sadly abused, but I am bound to express the belief that they are not at all so essential to the rearing of healthy children as their manufacturers lead us to suppose. Elsewhere [1] I have attempted a classification of these foods which gives them their proper place and value in the infant's dietary. The absolutely hopeless manner in which some practitioners try first one food and then another, in cases presenting difficulty in feeding, is evidence of the great lack of knowledge which many medical men display regarding the correct method of infant feeding. In one of my recent cases, an infant of four months had been given no fewer than four different artificial foods and two milk mixtures in a vain endeavour to correct the indigestion from which the infant was suffering. Curiously enough, this patient was restored to a fairly normal condition by giving it equal parts of scalded milk and water every two and a half hours. This "miraculous cure," which it was actually considered to be, is but one instance of many which might be brought forward in proof of my contention.

To sum up what I have said, the following suggestions

[1] *Manual of Children's Diseases*, 1905.

are offered, believing as I do that their adoption will go a long way towards the realisation of ideal infant feeding :—

(1) Every infant should be breast-fed unless the mother is unable to nurse, or is suffering from some condition which renders it inadvisable that she should do so.

(2) As a substitute for breast milk, scalded cow's milk is to be preferred to sterilised or other forms of "treated" milk.

(3) Gain in weight should not be looked upon as the chief criterion of the infant's progress.

(4) Artificial foods should never be used before the tenth month; and even then they should not be regarded as essential.

(5) In places where infant milk depôts are a necessity only medical men should be placed in charge. The physician of such a depôt must see to it that no milk is supplied to women who are able to nurse their offspring.

I am aware that I have only touched the border of a vast subject, but my chief object has been merely to throw out a few suggestions, and to point out what appear to be some mistakes commonly made in everyday practice in connection with infant feeding. Success in this department of practice depends more upon the exercise of common sense and the adoption of simple methods than perhaps on any other. It is the use of elaborate and hyperscientific methods which retards our progress at the present time, and hampers the average general practitioner in attaining to the success which his efforts merit. The nearer we approach to nature, the greater will be our progress towards a thorough understanding of the great question of infant feeding. We have the materials. Let us see to it that we handle them in the simplest and least intricate manner possible.

CHRONIC COLITIS AND ITS SURGICAL TREATMENT.[1]

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CHRONIC colitis is a condition about which our knowledge, until quite recently, has been derived almost entirely from the patient's symptoms and the appearance and nature of the stools. Rarely some additional knowledge, however, has been obtained when a post-mortem examination has been rendered possible owing to the death of the patient from some intercurrent disease. It is, I think, obvious that such means of investigating a diseased condition are not sufficient, and, as one would expect, the knowledge so gained has proved misleading and often erroneous.

Chronic colitis is classified in various ways, but the following may be taken, I think, as representing the general present opinion :—

Chronic mucous colitis.
Membranous colitis.
Chronic ulcerative colitis.
Follicular ulcerative colitis.

This is not a good classification, as will at once be obvious since several of these conditions may exist in the same case at the same time, and also because most of these conditions of the colon may occur as a complication of other diseases. But it is at present difficult, and even undesirable, to attempt any more accurate classification.

Recently we have been able to considerably augment our knowledge with regard to disease of the colon, owing to increased facilities in directly examining the colon. This is partly due to the fact that many cases have within recent years been subjected to operation, and a chance has thus been afforded of directly examining the colon, but more especially to the introduction of the electric sigmoidoscope, which has

[1] A paper read before the Ilford Medical Society.

enabled us to see the condition of the interior of the sigmoid flexure in all cases of chronic colitis. It is true that the sigmoid is only a small portion of the whole colon, but, fortunately for our purpose, it is also the portion most frequently and constantly affected. The instrument does not require the administration of an anæsthetic for its use, and causes but little inconvenience to the patient, so that we can use it to examine the condition of the bowel in all cases of colitis. This has now been the practice at St. Mark's Hospital, where we get a number of these cases for the last three or four years, and, as a result, much valuable information has been obtained.

Mucous colitis and membranous colitis are usually considered as separate and distinct conditions, but there is little, if any, justification for this, and I think the difference is only one of degree and not of kind.

In a typical case the patient is a woman between the ages of 25 and 50, nervous about herself and often markedly neurotic; she suffers from chronic indigestion, and, as a result, is only able to eat certain foods, and that with care and circumspection. She suffers more or less constantly from constipation, though at times this may alternate with diarrhœa. But constipation is a marked feature in the vast majority of cases. She will probably complain of a constant dull pain or sense of discomfort in the abdomen, often on the left side, and of never feeling well or able to get about or stand without bringing on the pain. Such a patient is usually unduly depressed, and will recount a long history to you, made up of numerous minute details of diet, pains, headache, etc., and will tell you that the stools contain slime and that the bowels will not act. Almost invariably she will attach what appear to be quite undue importance to the condition.

In some cases, there are severe attacks of pain in the abdomen of a violent colicky character, and these attacks may be accompanied by nausea and even vomiting. Such attacks usually follow a period of constipation, and are followed by more or less diarrhœa and the passage of large mucous casts of the bowel, and sometimes blood and sand. Definite attacks such as this are not present in all the cases, though exacerbations of the condition are always well marked. It

has been customary to describe those cases in which there is mucus in the stools more or less constantly, and when severe attacks do not occur, as mucous colitis, and to describe as membranous colitis the cases where mucous casts are passed, and there are definite severe attacks of pain and colic, while the word ulcerative colitis is often reserved for the cases in which there is severe and constant diarrhœa accompanied by blood in the stools and progressive wasting.

It is quite obvious that there is no hard-and-fast line between the different varieties of the condition. Though the condition is most often met with in women, it is by no means rare in men, and in my own experience men have been, almost as common as women, subjects of colitis. The condition is not a dangerous one and by itself is seldom if ever fatal, but its subjects often become physical wrecks and form one of the worst class of chronic invalids. They suffer from severe constipation in spite of taking innumerable aperients, and as a result they suffer from toxic poisoning from the bowel or auto-intoxication, with headache, muddy complexion, and all the other numerous secondary symptoms with which we are so well acquainted. They are often most miserable people and a nuisance to themselves and to their friends. The neurotic element is always very marked, and this has led to belief that the condition is a neurosis with secondary bowel symptoms, and that there is no local cause for the condition. This view has been very strongly supported by Nothnagel and other German writers, and has been very generally accepted. The constipation has been supposed to be the underlying cause for the condition, and all the treatment has been aimed at correcting this.

It is, however, difficult to believe that such symptoms as severe abdominal pain, the passage of large casts and bleeding can be the result of neurosis, and examination of these cases with the sigmoidoscope has led me to believe that mucous or membranous colitis, far from being a neurosis, is a condition resulting from some local cause in the colon. Further than that, I do not believe that it is a disease at all, but rather that it is merely a symptom just as is vomiting or hæmatemesis, and that it is as correct to say that a patient is suffering from membranous colitis because she passes mucous casts and blood,

as it would be to say that she had mucous gastritis because she vomited mucus.

What is called mucous colitis is only a symptom which may result from numerous different abnormal conditions of the colon. And our aim in treatment should be to find, and, if possible correct, the cause. The causes for the condition are numerous. It may be due to chronic inflammation of the mucous membrane of the colon, and with the sigmoidoscope this can be seen in many of the cases. It may result from chronic appendicitis.

I recently saw a lady, who, for about two years, had suffered from symptons of chronic mucous colitis, she had frequent attacks of pain in the abdomen, and suffered alternately from diarrhœa and constipation. There was mucus in the stools, and she had consulted two physicians who diagnosed mucous colitis. A sigmoidoscope examination satisfied me that there was nothing the matter with the sigmoid colon, and careful examination of the abdomen revealed a hard and tender swelling in the right iliac fossa. There was little doubt that she had been suffering from chronic appendicitis and that the symptoms were all due to this.

Cancer of the colon may cause symptoms of mucous colitis, and I have seen nine cases with symptoms of mucous colitis which, on examination with the sigmoidoscope, proved to be cancer of the colon. Adhesions binding down the bowel may also cause the typical symptoms of membranous colitis, and I have seen two cases in which a band of adhesions kinking the middle of the sigmoid flexure appeared to be the cause of the symptoms. Adhesions resulting from a pelvic abscess or from inflammation of the tubes or ovaries in women, from a gastric ulcer, or inflammation of the gall bladder, may result in symptoms of mucous colitis. Similarly, tumours pressing upon the bowel from without may be the cause, thus abdominal aneurysms have been known to cause the condition, and it has been suggested that a movable kidney may cause it.

Out of 36 cases of chronic colitis, which I recorded in the *Lancet*, June 15th, 1907, there were only six in which no local cause for the condition could be found. It was in that paper and upon that evidence that I first put forward the view that what had hitherto been called mucous or membranous

colitis should be considered only as a symptom, and that the neurosis is the result of the condition and not its cause. The only reason for assuming that the neurosis is the cause of the condition is that it is so commonly associated with it. But we see typical cases of mucous colitis where no neurotic element exists. And, on the other hand, we commonly see patients suffering from chronic prolapsed piles or fissure, who have become markedly neurotic as the result of their rectal condition, but we should not think of arguing that the piles had been caused by the neurosis.

I think, in view of these facts, we must look upon chronic mucous colitis as a symptom rather than a disease, and must not be satisfied to make a diagnosis of chronic mucous colitis and to treat the case with medicine or dietary, but must first look for the cause of the condition if we are to be successful in treatment.

Treatment.—The medical treatment of mucous colitis has not hitherto been very satisfactory, and in a fairly large proportion of the cases has either failed altogether, or has only resulted in temporary benefit. Dr. Hale White, in his article on the subject in the new edition of Prof. Clifford Allbutt's *System*, admits that in quite one-third of the cases medical treatment is a complete failure. The first essential in treatment is to first discover as far as possible the cause of the condition. Medical treatment should then be given a fair trial, but if unsuccessful or if an obvious lesion which can only be cured by operation is found, surgical treatment should be resorted to. In those cases where the condition is due to chronic appendicitis, cancer, or some localised lesion, removal of the disease if possible is of course indicated. There remain, however, a large number of cases where there is chronic inflammation of the mucous membrane but no removable local lesion.

Dr. Hale White and Mr. Golding Bird have recorded several cases of severe membranous colitis, which were treated by right inguinal colotomy with successful results, though in one case the patient had a relapse two years later. Right inguinal colotomy, however, is an objectionable operation and one to be avoided if possible; it is even doubtful if the patient is not better off with the colitis. To get over this difficulty

some operators have attempted to make a valvular opening into the bowel in much the same way as is done in gastrostomy. More recently the operation of appendicostomy has been introduced, and has been much advocated by Mr. C. B. Keatly. This consists of bringing the end of the appendix out of the abdomen through a small incision in the abdominal wall and stitching it to the skin. Two days later the end of the appendix, which protrudes from the abdominal wound, is cut off. A catheter can then be passed into the cæcum through the stump of the appendix, and through this the whole of the large bowel can easily be washed out as often as is considered desirable. This operation has none of the objections of a colotomy. When the catheter is removed the opening does not leak at all, and should be both liquid- and gas-tight. The patient can easily learn to wash out his colon for himself daily, and if necessary weak astringent or antiseptic drugs can be used to irrigate the bowel.

The symptoms seem to quickly clear up after the operation, and the patients get strong and their bowel symptoms disappear. The operation has now been done a great many times for mucous colitis, and the results seem most promising. One patient, upon whom I performed this operation about six months ago, is a labouring man, and had been quite unable to follow his occupation for many months, on account of constant attacks of pain and diarrhœa alternating with constipation. He has been back at work ever since he left the hospital, and is now quite well, and says that the appendicostomy opening causes him no inconvenience, and that he does not require to wear anything over it beyond his vest, as it never leaks. He is in the habit of washing out his large bowel every morning with warm water, and this does not take him more than a few minutes and causes him no inconvenience. The opening can very easily be closed by just passing a cautery into the mouth of the canal, and does not require an operation for its closure, but it should, I think, be kept open for at least a year, as there is otherwise a risk of the colitis recurring. This operation, by enabling the colon to be kept clean and washed out regularly, and, if necessary, allowing astringents to be applied to the mucous membrane, offers an excellent means of curing the condition, and, although a sufficiently large

number of cases are not yet available to enable us to say that it is always curative, at the same time I do not know of any cases in which it has failed when performed on a suitable case, and it must be remembered that it is only performed in those cases where medical treatment has already failed to do good. It has one great advantage, that if properly performed the operation is free from risk, and does not do the patient any harm or cause any inconvenience.

We have recently heard a great deal of a new operation for chronic constipation and colitis. I refer to ileo-sigmoidostomy. This operation aims at short-circuiting the whole large intestine and making the ileum drain directly into the rectum. It has been much advocated by Mr. Arbuthnot Lane for chronic constipation, and it has also been advocated for such conditions as I am dealing with this evening. At first sight it appears a very reasonable and suitable proceeding, but there are several important drawbacks to be considered.

It has now been proved by Mr. Arbuthnot Lane, and by other surgeons who have performed the operation, that the short-circuited large bowel, instead of simply contracting up and remaining an empty and useless tube, gradually becomes filled up and distended with fæcal material, giving rise to serious symptoms which necessitate further operative treatment. And, to draw a long story short, it has been found that, in order to render ileo-sigmoidostomy a successful operation, the whole colon from the cæcum to the sigmoid or rectum must be excised. Now this at once puts an entirely different complexion upon the matter. Complete colectomy is a most serious and formidable operation, necessitating a very large wound and considerable danger to the patient's life. Even in the hands of Mr. Lane, who is an acknowledgedly expert operator, the operation of colectomy and ileo-sigmoidostomy has been attended on his own showing by a mortality of over 18 per cent. from the operation alone, while even of those cases which recovered by no means all were cured of their condition. Now such a high mortality for an operation, which at most is only one of expediency, quite condemns it as unjustifiable, even if we admit the extremely doubtful propriety of entirely removing such an important organ as the colon. And although in a few rare cases, such as localised

tuberculosis of the colon, or congenital dilatation of that organ where the patient's life is seriously threatened, colectomy may be the proper treatment, I do not believe colectomy will ever become a recognised treatment for either chronic constipation or colitis.

Chronic Ulcerative Colitis.—This differs only in degree from some of the conditions in which symptoms of mucous colitis exist. It is, however, a definite disease existing in several different forms, differing from each other both in their morbid pathology and in the severity of the symptoms. It is a very difficult condition to classify in the present somewhat limited state of our knowledge, more particularly as ulceration of the colon not uncommonly occurs as a complication of many other pathological states, notably in disease of the kidneys, diabetes, paralysis invading the higher cord centres, typhoid, pneumonia, and so on. I do not propose to deal at all with these secondary forms of ulcerative colitis, but to confine my few remarks to the primary, or what at present we consider to be the primary form of the disease. It occurs principally in two forms that can easily be recognised, chronic ulcerative colitis and follicular ulceration.

Follicular ulcerative colitis is much the less serious disease. If we examine the colon through the sigmoidoscope in this condition, we can see numerous small punched-out ulcers with red raised edges, each of these being a broken-down follicle, The ulcers are never very large, nor do they extend, as a rule. deeper than the basement membrane. This condition is commonly found associated with other diseases of the intestinal tract, but I have seen several instances in which it occurred as a primary form of ulceration and without any other disease being present. The symptoms are similar to those already described for mucous colitis, but diarrhœa is a constant symptom, and there is almost invariably blood in the stools. This form of ulceration is never fatal, and in many cases healing will occur under suitable treatment.

The treatment consists in rest in bed with local irrigation of the colon, at first with weak solutions of peroxide of hydrogen and then with olive oil. The patient requires feeding up so that a full but easily digested diet should be given, to which, however, sufficient fat must be added to prevent any possibility

of hard fæcal material being formed. Those ulcers which can be reached through the sigmoidoscope can be touched with nitrate of silver or the galvano-cautery. It is important to distinguish this form of ulcerative colitis from the other and more severe form, as the same treatment in that condition might be dangerous by causing perforation to occur.

The other and more serious form of ulcerative colitis has a superficial resemblance to dysentery, and has even been described as chronic dysentery; the two conditions are, however, quite distinct. The ulcers are often large and tend to spread round the bowel, they are very irregular in shape and may extend over a very large area, so that in a bad case there is more ulceration than normal mucosa to be seen. The ulcers may invade the muscular coat, and perforation is not uncommon leading to general peritonitis or local abscess formation. When the ulcers are numerous or extensive in area the symptoms are very severe. There is serious and progressive wasting, continuous diarrhœa and tenesmus. I have seen patients whose bowels acted as often as 25 times in the 24 hours. There is much blood in the stools, and microscopical examination will show the presence of pus. This condition is a very serious one and a great many patients die from it. It used even to be thought that all patients with this form of ulcerative colitis died, but this is far from being the case if proper treatment is carried out.

When death occurs it may be from progressive wasting and exhaustion from the severe diarrhœa or from perforation and general peritonitis. In some cases pericolic abscess has occurred, and the patient has died from suppuration or from the secondary bursting of the abscess into the peritoneal cavity. Liver abscess may also occur in this form of chronic ulceration. In many cases, however, the disease is much more chronic, and when the ulcers are localised and not numerous the disease is very insidious and the symptoms most misleading.

Ulceration of the colon may exist for long periods and give little sign of its presence beyond intermittent attacks of diarrhœa and occasionally a little blood in the stools. There is usually, however, a more or less constant sense of discomfort in the abdomen, and careful examination will often reveal a point of well-localised tenderness in the course of the colon.

The ulceration is frequently in the sigmoid flexure or pelvic colon, and a sigmoidoscopic examination will often enable us to see the ulcers and make a correct diagnosis. In these more chronic cases localised pericolic abscess may form, and the condition has often been mistaken for cancer of the colon, and has sometimes been described as left-sided appendicitis. Sudden perforation may also occur, and quickly cause a fatal result from general peritonitis.

The treatment of this condition must, of course, depend on the severity of the symptoms and the extent of the ulceration. I have seen several cases of well-marked ulceration of this type recover with rest in bed and suitable irrigation of the colon without any operative interference. Many of the cases, however, will not recover even with the most careful medical treatment, and it is a great mistake to put off operative treatment unless well-marked improvement is taking place, as operative treatment to be effectual must not be postponed until the patient is seriously wasted and rapidly going downhill.

In the less severe cases appendicostomy, by allowing the colon to be frequently irrigated and kept clean, will enable the ulcers to heal, and as this is such a safe operation it should, I think, be tried first in all but the very severe cases.

In more serious cases, or when appendicostomy has failed to control the diarrhœa, a right inguinal or right lumbar colotomy is the proper treatment. A right lumbar colotomy is much less objectionable than a right inguinal colotomy, and in most cases will allow us to get above the disease. This, by giving complete rest to the colon, in addition to allowing its being washed out, will, unless done too late, often enable the patient to be saved.

Ileo-sigmoidostomy is quite useless in these cases, as the sigmoid is almost invariably involved and the anastomosis would not be above the disease.

THE AMBULATORY TREATMENT OF FRACTURES AS APPLIED TO OSTEOTOMY.

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THOUGH the cases selected for example are all the result of osteotomy of various kinds, they may be taken to illustrate the advantages of the ambulatory treatment of fractures in general.

There is little doubt, in the minds of most surgeons, that long continued immobility of fractures is to be avoided except in certain special cases, since it entails, amongst other disadvantages, so much inactivity of the muscles. The employment of massage to counteract this tendency, so warmly advocated by Lucas Championnière, has led to great improvement in the functional results, and also, incidentally, to greater rapidity in healing. The chief drawback to massage is that, in a very oblique fracture, the fragments are apt to be displaced, and special care must be taken to maintain immobility by extension, or other means, during the manipulations.

In his writings on the regeneration of bone, Bier has drawn attention to the modes of treating ununited fractures adopted by Thomas many years ago, which have received less recognition than they deserved. These consisted chiefly in vigorous manipulation of the fragments and percussion at the seat of fracture, with the object, it was understood, of stimulating the cells to more active proliferation. Bier maintains that the good effect is largely derived from the influence on the blood-vessels of the granulation tissue produced by traumatic inflammation, thereby causing greater circulatory activity in the vicinity and more profuse exudation of nutrient and stimulating fluid.

On whatever grounds this benefit may ultimately be admitted

to rest, it is certain that the ambulatory treatment, which consists of movement and employment of the limb, producing greater active hyperæmia, combined with its dependent position, producing passive congestion, results in a more rapid consolidation of fractured bones, provided always that there is no other condition to prevent union. Of such conditions, by far the most important is the interposition of soft tissues, especially tendon or aponeurosis, but also muscle, although it is true that mobility, with repeated separation of the fragments, must, by repeating more or less the conditions of the accident, delay union.

A similar objection, however, as obtains in massage, is encountered in resting weight on a limb with a very oblique fracture line; and, in order to prevent undue movement in such cases, it is necessary to enclose or protect the foot as well as the leg, so that the weight is borne by the hip as well as by the surface grip on the rest of the limb.

In the case of a transverse fracture, such as is made by a linear osteotomy, the problem is quite simple; the limb being encased in plaster, the weight is put on the sole of the foot, and is transmitted through the leg (with its fractured bone), while the plaster acts only as a splint to give lateral support without taking off much of the weight. Indeed, these fractures are, in many respects, ideal for this method, because they are made under favourable conditions of asepsis, the seat of the fracture is exactly known, and in none of them is there any interposition of soft parts. And certainly the results have been remarkably good, and have been free from any obvious objections, such as pain, swelling, or other disturbances.

In former years I had been in the habit of keeping the corrected limb in a splint for three or four weeks, until the wound had healed, and the bone had become well united. Only then was the plaster applied over a thick flannel bandage, which acted as a cushion, and this was maintained for another three or four weeks or more. The results were ultimately good, but there was usually some stiffness of the joints and atony of the muscles, which lasted for several weeks longer,

and entailed increased irksomeness and unnecessary delay to the patient.

In 1903, an interesting paper by M. von Brunn appeared in the *Beiträge zur klinische Chirurgie* on the treatment of genu valgum, as carried out in von Bruns' clinique at Tübingen. After a long series of cases, treated precisely on Macewen's lines, they gradually adopted the following modifications :— (*a*) the small osteotomy wound was covered up, and the limb, well smeared with vaseline, was immediately enveloped closely in a plaster casing; (*b*) in addition a Bruns' splint (corresponding almost identically with the well-known Thomas' knee splint) was applied outside, with a stirrup-piece below the foot, with which to support the weight in walking; (*c*) the patient was set to walk the next day, or soon after; (*d*) at the end of two or three weeks the splint was left off, but the plaster was renewed for another three weeks or so.

The previous year, I had seen Prof. Helferich treat genu valgum by first cutting the bone partly through, but delaying the fracture and correction for two or three days, until the plaster was in process of being applied close to the skin. Now, there are certain dangers in applying an inelastic casing over any injured limb, as the resulting swelling is so apt to cause compression of the blood-vessels, and lead to gangrene, or, in milder degree, ischæmic paralysis. Indeed similar, though slight, effects had been noticed in some of my earlier cases, in which an ordinary dressing had been applied completely round the limb over the osteotomy wound. Here the blood had stiffened the bandage into a hard case, and, by its compression, had caused considerable pain with swelling of the foot, which was immediately relieved when the dressing was removed.

Curiously enough, Helferich draws attention to those dangers in his own book on fractures, and illustrates them by typical cases. On this account, therefore, neither bandages nor long strips of gauze should be wound round a limb immediately after injury, without a sufficiency of elastic material beneath them to allow of expansion. The safest rule to adopt in applying plaster to any fracture is to await

the subsidence of the swelling, which, in an osteotomy, generally occurs within four days or so, unless there has been unusual bruising or manipulation.

For the last three or four years, then, I have followed those lines, and the results have fully justified me. The operations have been mostly supra-condylar osteotomies of the femur at the site indicated by Sir Wm. Macewen for genu valgum, with one or two cases of linear osteotomy for genu varum, and several excisions of wedges for tibial curves. Most of the former have been done subcutaneously, but where there has been such abnormality in the shape of the bones, as in cases with pronounced antero-posterior curves, I have not hesitated to make an open wound in order to determine the amount of section necessary for the deformed bone. For the removal of wedges, an open wound is of course necessary; and the dense bones, in several of my cases, were easily cut through with an electrically-driven circular saw.

In most of the cases of genu valgum, the femur has been cut almost through, and the bone bent first outwards so as to make the cut gape, and allow of easy fracture, and then bent inwards to make the necessary correction. For the after comfort of the patient, this correction should be complete and almost in excess, as any attempt to correct the deformity by elastic pressure of splints and dressings invariably causes pain, and may lead to pressure sores.

The steps of the treatment in most of the subjoined cases were as follows:—

After the deformity of the bone has been corrected, the wound, even if quite small, is closed by stitches in order to prevent any large exudation, and an absorbent dressing is applied. The limb is put in a padded splint in its fully corrected position. In three or four days, or, as soon after as is convenient, the dressings are removed, and if the swelling has subsided, and the wound shows no sign of further secretion or gaping of its lips, the stitches are not touched, but a small sealed dressing of gauze and collodion is applied, and the limb is encased in plaster of Paris from

the ankle to the groin. No padding of cotton-wool, or even flannel, is used beneath the plaster, as any elastic material is apt to become sodden with the perspiration and compressed, and so might loosen the plaster on the leg, but the skin is protected by a thin stocking of webbing. This ensures the accurate fitting of the plaster to the limb and the immobility of the fragments, so that the patient can walk about without fear of their displacement. The material most useful for this purpose is a long tubular bandage of stockinette ("tricot"), cut to the appropriate length, which is drawn over the limb without wrinkling, the ends being left long enough to fold over the plaster above and below while it is still wet, so as to make the edges smooth and round and to prevent chafing of the skin.

With ordinary care there is little liability after the first day or two of the fractured limb bending while the plaster is being applied, especially if gentle traction is made meanwhile. Once or twice there has been a complaint of momentary pain, and, as most of the patients are children, there is often crying at first when the limb is taken out of the splint, but I have satisfied myself that this is chiefly due to fright, and it has generally subsided when the child's attention has been diverted to the making of "mud pies" on its legs.

As soon as the plaster is dry and hard, the patient is got out of bed and encouraged to walk, first with crutches, afterwards with the help of a stick only, so that the limb may be trained to bear the weight of the body. It is surprising how little pain and difficulty are felt in walking even four or five days after the operation. The only failure which I have had in this respect was with Case 11, with greatly distorted limbs, which entailed division of both femurs and removal of wedges from both tibias: but as the child had never walked a step before, his feeble attempts to walk after the operation may be considered as a partial success, and there are hopes of much greater improvement.

In the earlier cases, I was, perhaps, unduly cautious in delaying the application of plaster, but it was soon seen that

there was little reason to fear any ill effects. In many circumstances, of course, the more rapid cure of such deformities is of little importance, but there is no excuse for protracting the treatment over an unnecessarily long time. The table shows the length of residence in hospital after the operation, and, in one or two cases, the number of days between the operation and the application of the plaster. When this is not mentioned, it was generally five or six days, and the patient remained in hospital till able to get about without assistance. Most of the patients went to a convalescent home for a fortnight; and after four or five weeks from the operation, the plaster was taken off, the stitches were removed, and the patient was encouraged to use the limbs freely without further support (except in two instances), and to practise walking up and down stairs, in order to make the joints supple. Indeed, the first patient, treated on these lines (J. McG., No. 5), had his plaster removed 37 days from the time of operation, and proceeded to dance what he called a jig for the entertainment of his fellow inmates of the hospital. Provided that there are no evidences of active rickets, it does not appear necessary to retain the plaster any longer, since the bones by that time have become firmly and solidly united, and, the deformity being corrected, there is little tendency for the bones to bend.

I had an opportunity of assuring myself of the results of this procedure in the following way. R. R. (Case No. 15) returned to hospital for a repetition of the operation six months or so after the first. When the limb had been previously put up in plaster, it was seen that, owing to other deformities, the left leg was not sufficiently corrected; and, being pleased with the result on the right leg, the patient preferred to undergo the operation again. At the first operation, the plaster had been put on within ten days, and was off within four weeks; and, according to measurements taken at his previous dismissal and at his second admission, there was evidently no bending, and the bone in the vicinity of the old operation was apparently similar in density all over.

Another case (A. T., No. 19) had been operated on in

another hospital, four years before, but one leg was not sufficiently straight for her taste, indeed the original deformities must have been extreme and complex. Here the bones were firmly and well united, and showed no sign of the former section, and, as the old operation had left the leg in a more favourable condition for correction, a good result was obtained.

Two of the patients, W. B. (No. 14) and J. B. (No. 11), were uncle and nephew, and both were the subject of marked rickety deformities ; and, curiously enough, both had always been troubled with persistent incontinence of urine, as was also the father of W. B., and also an older brother of J. B., another rickety subject, but not sent for operation. In the case of J. B. this incontinence gave rise to much trouble from wetting of the plaster, necessitating several changes, and so delaying his dismissal.

It will be seen that, after September 1904, there is a general shortening of the stay in hospital, till in two cases the patients were able to be dismissed in six days in one instance, and seven days in the other, good results being seen some time after. That there is little harm in early ambulatory treatment of such cases, provided the limb is well supported, may be seen by a demonstration of a patient by Dr. Höftmann at the Königsberg Medical Society, some time in 1902, walking six hours after operation. The limb had been put up immediately in plaster with rubber padding round the upper edge. This was no doubt a *tour de force*, but it shows what results can, if necessary, be obtained.

I have treated several cases of wiring of ununited fractures by this method, and, though some cases were delayed by the prolonged exudation caused by the necessity of much dissection and handling, others, where the effusion has been no greater than in osteotomy cases, have done very well, and the patients have been able to walk about in the course of a few days. I believe that many more might be treated as out-patients, where the fractures are suitable for this method, who otherwise take up room in an already

crowded hospital.

No.	Name.	Sex.	Age.	Admitted.	Deformity.	Limbs.	Operations.	Operation.	Dismissed.	Days after Operation.
1	H. McL.	m.	11	'03, Sept. 23	Genu valg., tib. curves, L.	1	2	Sept. 25	Nov. 8	44
2	J. K.	m.	14	„ July 24	„ „ R.	1	1	Aug. 7	Oct. 3	56
„	„	„	„	„ „	„ „ L.	1	1	Sept. 6	„	27
3	M. F.	f.	7	'04, Feb. 24	„ „ R. & L. (pl., Mar. 30)	2	2	Mar. 11	Mar. 31	20
4	R. McG.	m.	7	„ May 22	„ „ tib. curves	1	2	June 6	Aug. 6	61
5	J. McG.	m.	17	„ Sept. 7	„ „ R. & L. (pl., Sept. 17)	2	2	Sept. 8	Oct. 1	23
6	R. D.	m.	11	'05, Mar. 31	„ „ R.	1	1	April 4	April 30	26
7	M. K.	f.	13	„ Sept.	„ „ L. (pl., Oct. 3)	1	1	Sept. 23	Oct. 11	18
8	C. B.	f.	5	'06, April 3	„ „ R.	1	1	April 11	May 29	48
„	„	„	„	„ „	„ „ L. (pl., May 28)	1	1	May 19	„	10
9	K. D.	f.	17	„ July 23	„ „ L.	1	1	Aug. 13	Sept. 3	21
10	G. W.	m.	6	„ Sept. 17	„ „ R.	1	1	Sept. 20	Oct. 5	15
11	J. B.	m.	4	„ „	„ „ R. & L. and tib. curves	2	4	Sept. 25	Nov. 10	46
12	A. McN.	f.	7	„ Oct. 3	Tibial curves, R. & L.	2	2	Oct. 9	Oct. 27	18
13	E. J.	f.	13	'07, Mar. 29	Genu valg., R. & L.	2	2	April 11	April 26	15
14	W. B.	m.	15	„ April 13	„ „ R. & L.	2	2	April 15	May 10	25
	„	„	„	„ May 4	„ „ L., refractured	1	1	April 25	„	15
15	R. R.	m.	11	„ „	„ „ R. & L.	2	2	May 18	May 31	13
„	„	„	„	„ Oct. 4	„ „ R. repeated (pl., Oct. 10)	1	1	Oct. 5	Oct. 12	7
16	A. McA.	f.	12	„ May 30	„ „ R. & genu, varum L.	2	2	June 11	June 28	17
17	M. B.	f.	12	„ July 29	„ „ R. & L.	2	2	Aug. 13	Aug. 26	13
18	G. K.	m.	10	„ Sept. 12	„ „ R. & L.	2	2	Sept. 17	Sept. 28	11
19	A. T.	f.	15	„ Sept. 28	„ „ L., fem. curve	1	2	Oct. 14	Oct. 10	6

SOME RECENT LITERATURE UPON ARTHRITIS.

A REVIEW AND COMMENTARY.

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INFLUENZA AND ARTHRITIS.

What promises to be one of the most interesting advances in the study of arthritis is the isolation of the influenza micro-organism, by L. Dudgeon and Adams, from the arthritic exudations (*Lancet*, September 7, 1907).

The case was one of a female infant, aged 10 months. She was the youngest of a family of six, all healthy, and there was no history of disease in the parents.

She had been ailing for two months, and, at the end of the first month, it was noticed that the left elbow was swollen, and the condition was thought to be an epiphysitis. A week later, the mother having omitted in the meantime to bring the child for admission, she was again seen, exceedingly ill, and with suppurative arthritis of the elbow joint. The right hip joint was also thought to be affected, and there were evidences of meningitis. Death rapidly ensued from pyæmia, and from the elbow joint, from a large abscess in connection with the right hip joint, and also from the spleen, a non-Gram-staining, small bacillus was isolated in pure culture. This was apparently identical with the bacillus of influenza.

Should future investigations confirm the presence of the influenza bacillus in arthritic exudations, it will be a distinct step forward in the delimitation, or possible destruction of the "specific disease" rheumatoid arthritis. The tendency for "rheumatoid arthritis" to arise after influenza, or to be aggravated by that disease, is generally recognised. It has now become more probable that, in these cases, we are dealing with an active influenzal arthritis, which is usually non-suppurative, but which, in the case reported above, became pyæmic in type. The removal of this group from rheumatoid arthritis (using that term in the sense of a specific disease) would perceptibly narrow down its already diminishing territory.

RHEUMATOID ARTHRITIS.

The Exeter meeting of the British Medical Association led to a revival of the discussion upon rheumatoid arthritis. The result, though not convincing, was of interest as an epitome of the most recent views upon the pathology and treatment held in this country at present.

The full discussion will be found in the *British Medical Journal*, October 26, 1907.

A. P. Luff introduced the subject in a short paper, which contained very definite opinions. One was to the effect that rheumatoid arthritis was an entity, and a general constitutional affection. He stated his belief that the micro-organism gained access to the joints and general system by various channels, among the most important of which is the alimentary canal. Mon-articular rheumatism he believed to be always traumatic in origin, and, when there were degenerative processes in the bone and cartilages, should be separated off as "osteo arthritis." He held there was an acute and chronic form of rheumatoid arthritis, the acute being distinguished from sub-acute rheumatism by its failure to react to salicylate of sodium. Any debilitating influence predisposed to this disease, and in particular influenza.

Luff's remarks on treatment were equally decisive. The disease must be recognised early, and treated with perseverance. The most important medicaments are guiacol and iodide of potassium. Guiacol is best given in cachets as the carbonate, commencing with 5 to 10 grain doses, and increasing to 20 three times a day. The best climate is Egypt. Massage, baths, and passive movement are of the greatest value in restoring the general nutrition and mobility of the joints after the acute phase is over.

A prolonged and animated discussion followed.

W. Strangeways, who has organised at Cambridge an elaborate investigation upon the subject, was so replete with facts that, in the allotted time, he was unable to do more than state that his opinion upon the pathology of the disease was entirely opposed to Luff's, and that there was no such entity as rheumatoid arthritis.

McCrae, of the Johns Hopkins University, held that the disease was a definite one, and the result probably of some

infection, and that it, in his experience, was distinct from acute rheumatism. He commented upon the difficulties in diagnosis, and emphasised the value of the X-rays in these cases as a means of diagnosis. On the subject of treatment he was explicit. First search must be made for the site of infection, then general measures, akin to those used in the open-air treatment of tuberculosis, were indicated. Iron and arsenic were the most important tonics. Local measures, such as light massage and passive movements, should be commenced as early as possible. Bier's method of passive hyperæmia was valuable for the relief of pain, and Paquelin's cautery was a valuable method of counter irritation. Lastly, treatment must be determined and continuous.

Ringrose (Llandrindod Wells) upheld the view that the disease was the result of a specific infection usually from the gastro-intestinal canal, and emphasised the frequent error of mistaking the disease for gout. He regarded the treatment of alimentary disturbances as of first importance. With regard to other measures, his experience supported the previous speakers.

Midleton (Bournemouth) doubted a specific infection, and strongly recommended Latham's method of treatment by continuous counter irritations over the lumbar and cervical spine.

Tyson (Folkestone) held that the chief factors for success were prevention, and early treatment by dry, well-ventilated rooms, and regular and systematic exercise of all joints.

Preston King (Bath) thought it was not a specific, but in man a constitutional disease, and held that it was very closely connected with gout.

J. Odery Symes (Bristol) stated that, in subacute rheumatism, the fluid from the joints showed a polymorphonuclear leucocyte count, but, in rheumatoid arthritis, a mononuclear count, and defined his conception of the disease in its early stages.

Michael G. Foster (San Remo) considered that all drugs, other than cod-liver oil, were useless except for the relief of pain. He had found much good from electric baths.

D. B. Lees (London) held that "rheumatoid arthritis" was a group of diseases. Some he believed to be rheumatic, and,

in such, he had obtained admirable results with very large doses of salicylate of soda (400–500 grains daily).

F. J. Poynton (London) remarked only upon the pathology of the disease. If the arthritic changes were alone considered, he maintained that many infections could produce them in animals, and he believed also in man. Any infection he thought might produce simple, rheumatoid, or osteo-arthritis and certainly, in animals, the rheumatic organism might do this. That there was a *disease* rheumatoid arthritis was possible, but not proven. He held that there were two aspects of the question, one the soil or constitution, the other the infection producing the local lesion, and was in accord with Dr. King's view of a rheumatic gout, in which he considered that gout made the soil, and that rheumatism was the infection.

A. W. Sikes (London) believed that gout and rheumatism bore a definite relation to rheumatoid arthritis, and thought that the bacterial element was a frequently a late event.

E. L. Fox (Plymouth) relied on massage, superheated air, and diet for successful treatment.

J. W. Draper (Huddersfield) advocated concrete floors and avoidance of water in the cellars for prevention, together with treatment of the alimentary canal.

V. T. Greenyer was in favour of surgical treatment of the large joints when the disease was severe.

T. Morrell Thomas (Newport) relied on a warm, dry climate, open air, ample diet, and local massage.

THE TREATMENT OF NON-TUBERCULOUS CHRONIC ARTHRITIS.

Locke and Osgood : *The Journal of the American Medical Association*, February 2, 1907.

The authors follow Goldthwaite's classification of these conditions into :—

(1) Villous arthritis ;
(2) Infectious arthritis ;
(3) Atrophic arthritis, including many cases of rheumatoid arthritis ;
(4) Hypertrophic arthritis, including the types of osteo-arthritis.

They first deal with the general indications :—

(1) The correction of disturbances of general health.

(2) The search for any evidence of a local focus of infection. The middle ear, the teeth, etc.

(3) The corrections of deformities by surgical operations and special apparatus.

Diet is to be considered upon general principles.

Under special treatment, they emphasise the following points :—

In chronic villous arthritis, the correction of deformities, of obesity, and of faulty positions of the joints. In more intractable cases, the removal of the villous processes.

In infectious arthritis, they rely largely upon the value of active hyperæmia, hydrotherapy, and massage.

In atrophic arthritis, a warm, dry climate they hold is of great importance, and massage and movements useful. The correction of deformities is also a necessary undertaking.

On the other hand, in hypertrophic arthritis, passive move ment and massage are not as a rule effective, and the main principle of treatment is rest.

Under physical therapy they deal with :—

1. Hyperæmia : (*a*) *active*, as produced by the use of hot air ; (*b*) *passive*, as in the congestive method of Bier.

Their experience of these two methods accords with Bier's, in finding that the active hyperæmia is more suitable for chronic arthritic affections, the passive for the acute.

The results they have obtained with the Bier method have been :—

(1) A lessening of pain ;

(2) Bactericidal action ;

(3) An increase in absorption ;

(4) Resolution of proliferated tissues ;

(5) A regenerative influence on the tissues (Bier).

2. Massage is of much value :—

(1) for increasing the nutrition of the joint ;

(2) for promoting absorption of the joint effusion ;

(3) for diminution of the œdema ;

(4) for stimulation of the trophic nerves ;

(5) relief of muscle spasm.

3. Hydro-therapeutic measures.

The importance of rest in acute conditions is emphasised, but the care, with which this must be undertaken, is also insisted upon, for fibrous adhesions are liable to form in a very short time, and muscular atrophy to supervene with increased rapidity. They emphasise :—

Protection by suitable clothing of the affected joints.

The most favourable climate is a dry and equable one with abundance of sunshine.

The writers have but little faith in the use of salicylates or iodides, even for the acute exacerbation, but prefer arsenic and iron, and the occasional use of intestinal disinfectants.

RHEUMATIC FEVER.

The *Journal of the American Medical Association*, for February 2 and 9, 1907, contains papers which are of considerable value to all who are interested in rheumatic fever, and in particular rheumatic fever in childhood.

It would appear that, as a rule, in America, acute rheumatism is not such a frequent or severe illness as it is in this country. The writer is not led to make this statement entirely from the study of the literature of American writers, but from the personal statements made to him by experienced physicians from that country.

First, with regard to the ætiology of the disease, there are two valuable reviews of the recent work that has been done upon the subject, one by Connor, of New York City, in the *Journal* for February 2, and one by Dunn, of Boston, February 9. In both, full and generous allusions are made to the English researches upon this point. Their conclusions are very similar to those which have been recently published by Bulloch in his article upon the subject in the recent Volume II. of Clifford Allbutt and Rolleston's *System of Medicine*.

Thus Connor concludes:—

"1. That acute rheumatism is a specific infectious disease, and is not merely an attenuated pyæmia resulting from the common pyogenic organisms.

"2. That the bacillus of Achalme has no ætiological relation to acute rheumatism.

"3. That, although there is considerable evidence in favour

of the view that the disease is caused by a specific diplococcus or streptococcus, positive proof of the specificity and identity of this organism, and of its causal relation to rheumatism are still lacking."

This paper contains a number of useful references.

Dunn, in the *Journal* for February 9, concludes:—

"At present, it seems advisable to accept the micrococcus rheumaticus, not as the absolutely proven specific cause, but as the probable specific cause of rheumatic fever."

There is, in this paper, also a valuable collection of references to the literature of the subject.

In this contribution there is, in addition, an admirable clinical study of rheumatism in childhood, founded upon 300 cases and extending over a period of five years. This enables us, in this country, to understand rheumatism as it occurs in Boston, and a very brief summary of the chief headings will be of interest.

1. *Clinical Statistics of Rheumatic Fever in Childhood.*—Dunn found that by far the most frequent cause of arthritis and endocarditis was the unknown one of rheumatic fever; that cardiac affections were far more frequent in childhood, and that the disease was practically non-existent under three years of age.

The experience of English writers is almost identical.

2. *The Articular Cases.*—The first point noticed was the comparative mildness of the symptoms. Another, one of practical importance, was the comparative frequency of monarticular lesions, an experience which the writer would support with regard to articular rheumatism in childhood in London. The frequent association of arthritis with endocarditis was very noticeable, and the rapidity with which the fever subsided, in purely articular cases, was also apparent.

3. *Cases of Endocarditis*—In the series of 300 cases, the heart was affected, in some way or another, in 281. How closely this approaches the experience of D. B. Lees, who maintains that a cardiac affection is almost a constant occurrence in acute rheumatism, is noteworthy.

In this series, heart disease was not infrequently the first evidence of rheumatism, and was, in some instances, singularly free from any symptoms that attracted attention.

The cases of chronic heart disease, which were admitted into the hospital, were found, on enquiry, to be mostly associated with previous rheumatism or chorea.

Pericarditis was usually associated with endocarditis, and sometimes with chorea, tonsillitis, or arthritis.

One conclusion arrived at by Dunn is identical with a conclusion arrived at in this country, viz., that the most frequent cause of cardiac failure from ruptured compensation in rheumatic children is not overstrain, but a fresh attack of rheumatism.

CHOREA.

Here again this independent investigation proves conclusively the close association of chorea and rheumatism. Eighty-six of the 300 cases gave a history of chorea, and out of 121 cases admitted for chorea, 69 gave a history of existing or pre-existing rheumatic fever. Dunn is fully alive to the fallacy that arises from counting as non-rheumatic those cases which show no history of rheumatism, and he gives clear examples of the occurrence of rheumatic fever following the original chorea. Here again we find the old truth emerging, that one has no right to assume that a chorea is not rheumatic until the life of the patient has been lived, and even then it is equally just to assume that this was the solitary manifestation of rheumatism, as all admit may be the case with the arthritis.

SORE THROAT AND RHEUMATISM.

In 98 of the 300 cases a distinct history of sore throat was obtained, and it is specially noted how insignificant the indications of a throat affection may be in children, and how easily the frequency underrated.

No allusion is made to nodules, a curious point, for in this country they are, in some outbreaks, a frequent occurrence, and they may even be the prominent features of the case.

PROGNOSIS.

The real gravity of rheumatism in childhood is conclusively shown by Dunn's series. Forty-five of the 223 examples of acute infection died; that is about 1 in 5. Heart disease was the cause of death in all cases. Only 17 patients out of 300 were discharged quite well.

In this valuable contribution to our knowledge of rheumatic fever one point stands out, namely, that an investigator, by an entirely independent series of observations, arrives at the conclusion that it is a peculiar disease, and not to be confused with other diseases.

This conclusion, it may be added, has been arrived at with a full knowledge of the widespread view that rheumatic fever is the result of many and varied infections, and is directly opposed to its acceptance.

THE RELATIONS BETWEEN TONSILLITIS AND ACUTE ARTICULAR RHEUMATISM: WITH PARTICULAR REFERENCE TO THE TREATMENT OF POST-ANGINAL RHEUMATISM.

Kieffer: *American Medicine*, September, 1906.

The writer recapitulates some of the accumulating evidence in favour of a tonsillar infection as a cause of rheumatic fever, and reports favourably of the following method of treatment:—

Free use of saturated solutions of sodium bicarbonate to cleanse the tonsils, and then the application of a fine powder of aspirin to the tonsils. The applications were made thrice daily. In addition a free calomel purge was given.

The redness and swelling of the tonsils rapidly disappeared, and were replaced by some blanching of the tissue. The general condition of the patient improved. No secondary lesions and ulcerations were observed. Convalescence took place, as a rule, in three days. The development of post-anginal rheumatism was apparently arrested.

OBSERVATIONS UPON ARTHRITIS IN YOUNG CHILDREN.

F. J. Poynton: *Edinburgh Medical Journal*, September, 1907.

The author deals with arthritis under the age of five, and points out that it may be not at all easy of diagnosis. Three especial difficulties are its separation from scurvy, infantile paralysis, and epiphysitis.

The first form considered is the *Gonococcal*, which was elucidated by Clement Lucas, in 1885. The usual period of its occurrence is within the first three months of life, and the source of infection, an ophthalmia resulting from a gonorrhœal

discharge from the maternal passages. It is usually a poly-arthritis, and the knee-joints are particularly liable to be affected. The course is, as a rule, favourable, and recovery occurs in about a month without surgical intervention.

Meningococcal Arthritis.—Two cases are described, in which this form of arthritis was a prominent feature of the illness.

As a rule, this arthritis appears as a comparatively unimportant feature in the course of the meningitis. The periarticular tissues are especially affected, and the lesions may be almost painless.

In the two cases recorded, one was remarkable because the arthritis was a notable feature, and attended with great pain. The infant subsequently developed all the most salient symptoms of post-basal meningitis, and died. The other case, also fatal, was remarkable because there was much intra-articular effusion into both knee-joints, which disappeared immediately before death.

In neither case was the meningococcus isolated from the synovial fluid, but, in the former case, though lumbar puncture was negative, a meningococcus was isolated from the cerebral and spinal meninges.

The author gives an example of *acute tubercular arthritis*, complicating a fatal tubercular meningitis, and compares the syndrome with that of meningococcal arthritis.

Acute *rheumatic arthritis*, though rare in children under five, is nevertheless a sufficiently common occurrence to require attention. He gives examples of severe rheumatic fever at two and three years, ushered in by arthritis, and emphasises the difficulty of distinguishing, in infants, rheumatic stiff neck from early spinal caries.

Another important form of arthritis in young children, originally described by Dr. Still, and characterised by (1) a chronic progressive course, (2) splenic enlargement, and (3) enlargement of the lymphatic glands, is commented upon, and attention drawn to the border-line cases, in which there is in addition advanced valvular disease, an uncommon event not noticed in any of Dr. Still's original two-and-twenty cases.

Lastly, three arthritic affections in hæmophilia are alluded to—

(1) Hæmorrhage into the joint cavity;

(2) Rheumatoid changes secondary to the hæmarthrosis;
(3) Articular lesions of a rheumatic type in the hæmophilic.

A LECTURE ON ARTHRITIS.

F. J. Poynton: *Medical Press and Circular*, April 1, 1907.

In this paper, arthritis is studied as a symptom of various diseases, and not as a disease in itself, and the various structures of the joints are considered under the following headings:—

(1) The synovial membrane and exudation;
(2) The joint capsule and ligaments;
(3) The cartilages;
(4) The bones;
(5) The bursæ;
(6) The muscles.

(1) Under the synovial membrane and exudation, the writer considers the value of aspiration as a means of diagnosis of the nature of the arthritis. Investigations tend to show that the method is only partially helpful. For, although the subject has not been thoroughly elucidated, there seems good reason to believe that, in early stages of infective arthritis, the infection is often not present in the exudation, or if it is, it cannot be isolated. Again, in chronic arthritis, the same difficulty is met with, for the exudations are frequently sterile. In other cases, micrococci are present in the films of the fluid, but fail to grow on any ordinary medium. When the process is acute, and there is a good deal of turbid fluid and fibrinous deposit, or when the infection is highly virulent, the cultures are usually positive. The writer is doubtful that the cause of the pain, in gouty arthritis, is the result of the deposit of crystals of sodium biurate, seeing that they are, in their commencement, exceedingly minute, and he believes the pain to be the result of the active reaction of the gouty tissues to inflammatory changes.

Under the heading of the *joint capsule and ligaments*, emphasis is laid upon the great practical importance of avoiding undue strain on these structures, when softened by inflammatory change. A plate is given, showing perivascular fibrosis around the blood-vessels in the thickened synovial membrane

from a case of rheumatoid arthritis. This process must interfere with the nutrition of the tissue and delay recovery.

The *cartilages* are affected, partly by ordinary wear and tear, and partly by disease. Experimental investigation tends to show that many different infections may produce a similar arthritis, and that all such lesions, when intractable, damage the cartilages; when acute and not severe, produce a simple synovitis.

The bones are also affected in arthritis in several different ways. Virulent septic infections eat away the bone; pressure on bones, denuded of cartilages, produces eburnation, chronic processes of a subacute type produce bony outgrowths, and a plate is given showing an experimental "guttering" of bone by a non-suppurative process. If the inflammation is within the bone, then either sclerosis or atrophy, with porosity, results. This latter process is aided by disuse.

JOINT AFFECTIONS IN NERVOUS DISEASES.

L. Barker: *The Journal of the American Medical Association*, February 2, 1907.

Barker classifies these as follows:—

(1) The intermittent joint effusions;
(2 The arthropathies of tabes, and general paralysis;
(3) The arthropathies of syringomyelia;
(4) The painful joints of psycho-neurotics.

The Intermittent Joint Effusions are characterised by periodical swellings of the joints with, as a rule, no fever, local redness or heat. The periodicity varies and occurs most usually about every 14 days; it may occur every three days or at each menstrual period. The duration also varies lasting usually three or four days; it may last over a week.

Barker holds that these cases are almost certainly of angio-neurotic origin, and remarks that the arthritic swelling may be replaced by a polyuria, or by profuse sweating and reddening of face. He does not think that the condition has anything to do with infection. He warns against operative measures, and favours rest and the application of a flannel bandage, general hygiene, and arsenic.

2. *Tabetic Arthropathy.*—Barker quotes Henderson's statistics with reference to the time of onset of the arthropathy,

which show that this is most frequent in the ataxic stage, and rare in the paralytic stage. Almost any joint may be affected, though the small joints are less frequently implicated than the large. Pain is exceptional, but was noted in 20 out of 333 cases. Redness is also unusual, but a very characteristic occurrence is a sudden firm swelling of the joint tissues, which does not pit on pressure. This may supervene with great rapidity, and spread beyond the limits of the joint. It may also disappear rapidly. The condition may be grouped into benign and malignant forms, but the benign forms may be converted into the malignant by neglect and over-use, a danger which is particularly liable to happen owing to the painless character of the lesions.

3. *Arthropathies in Syringomyelia.*—About 10 per cent. of these cases apparently suffer from arthritic affections, males greatly exceeding females. The average time of onset is the 40th year, but it may occur in childhood. The arthropathies usually precede the muscular atrophies, and, in contra-distinction to the tabetic form, the upper extremities are more frequently attacked than the lower. Injury is a common antecedent.

There is usually a sudden swelling, and some pain at the commencement of the process. This subsides, to be followed by a gradual, and now painless, enlargement of the joint. In advanced cases, the ends of the bones of the articulation are often considerably enlarged, and the capsule thickened. In rarer cases, there is general atrophy of the joint tissues. Exostosis may develop, spontaneous fracture and dislocation occur. Habitual dislocation of the shoulder is a frequent mishap. The course of the disease is chronic.

The treatment mainly consists in rest, and the treatment of deformities.

4. *The Painful Joints of Psycho-neurotics*—"Hysterical joints." The joint most often affected is the knee, then the hip and shoulder. The two prominent symptoms are pain and disturbance of functions. Muscular spasm is frequent, and although atrophy is, as a rule, slight, it may in advanced cases be extreme. Nocturnal startings and exacerbations of pain at night are absent, but there is unbearable pain on making passive or active movements. Between the

attacks, there will generally be found hyperæsthesia over the joint.

The differential diagnosis from organic disease may be most difficult. The behaviour of the symptoms under, and on recovering from, anæsthesia is of some value. Under the anæsthetic, the contractions disappear, and the joint now seems quite natural. On recovery, the sensitiveness of the skin returns first, and it is not for some thirty minutes that the deep pain and contractions return. The treatment is largely one of occupation, therapy, and will-gymnastics; coupled with, at first, isolation from friends, and a milk diet, and later passive movements.

INTERMITTENT HYDARTHROSIS.

A special notice of this interesting condition has been given by A. E. Garrod in the recently published Volume III. of Clifford-Allbutt and Rolleston's *System of Medicine*.

First described by Perrin, there are two classes of cases, one, in which the joints return to normal between the attacks of hydrops, the other, in which the hydrops occurs as a feature in the history of a diseased joint.

The starting point may be an injury, and in the primary cases, in females, attacks have sometimes been more severe when coincident with menstruation. The secondary cases have been associated with rheumatoid arthritis, gonorrhœal arthritis, and staphylococcal osteomyelitis. The condition has been associated with such nervous affections as exophthalmic goitre, epilepsy, and giant urticaria. The feature of all these cases is their periodicity. The pathogeny is obscure. Cultures have almost invariably been sterile, and the most accepted view allies the condition with angio-neurotic œdema.

The clinical features are a periodical and rapid filling of the articulation (almost invariably one knee or both) with fluid. Local heat and redness are exceptional; and the temperature of the joint is not apparently raised. The periodicity differs in the individual. Eight to eleven days is the usual cycle. The phase of distension lasts about three days. There may be no constitutional symptoms, or those of general malaise. Pain is not a marked feature. The outlook is uncertain. Some cases last for years, others have ceased spontaneously, or have been cured.

Among drugs arsenic stands first, and quinine next. Electrical and local surgical measures have also had successes Rest is unavailing, and pressure cannot be borne.

The article closes with a valuable bibliography.

THE JOINT AFFECTIONS OF HÆMOPHILIA.

Sheldon: *Medical Record*, October 27, 1906.

Sheldon dwells upon the difficulty in the diagnosis of these cases, and instances one remarkable case of hæmorrhage into the right ankle joint of an infant, on the fourth day of life, which followed hæmorrhage from the bowels and purpura with fever. There was, however, no proof that this was a condition of hæmophilia.

Other cases are given illustrating the dangers that may arise from operations in these cases, and of the association of fatal hæmorrhages from the bowels together with the hæmarthrosis.

Eikenbury, of Chicago (*Medical Age*, February 10, 1906), briefly records a remarkable case of a boy, of 11 years, who, at seven years of age, damaged his left hip. Some years later he developed a severe illness, with high fever and multiple arthritis. There was no suppuration, but some history of blood in the urine.

Articular pains had recurred from time to time since that date. His condition, as described by Eikenbury, showed ankylosis of both wrists and of several digits. Both elbows were also ankylosed, and the movements of the shoulder and knee joints much impaired, and grating was detected in both the latter articulations. Both ankles, the jaws, and the cervical vertebræ were also ankylosed.

Radiograms showed the bony nature of the lesions in the diseased articulations.

PAINLESS EFFUSION INTO THE KNEE JOINT.

Sir William Bennett: *Hospital*, November 16, 1907.

In an interesting lecture upon this condition, Bennett points out the great strain on the knee joint, on account of leverage upon it, and the comparatively small degree of protection of the synovial membrane, owing to the thin superjacent tissues.

He divides the cases into three classes:—

(1) Those with or without local heat, occurring at any time of life ;

(2) Those occurring in the young at the time of adolescence ;

(3) Those occurring in adults and old people.

He then proceeds to point out that weak muscles, a flaccid joint capsule, and unusual lack of rigidity in the joint, may frequently explain an effusion. Such examples are bilateral, and there need not be any pathological change in the joint.

These painless effusions are particularly liable to occur after severe exercise. A correct investigation of these joints should include examinations when the patient is standing up and lying down. In these cases, the doctor must always be on guard against tubercular disease, but Bennett, from his experience, is inclined to believe that tubercular arthritis is diagnosed too frequently in such circumstances. If this is done, rest is relied upon, when massage and passive movements are the correct remedies. A persistent though possibly slight increase in local heat is important evidence of tubercle.

Painless Effusion occurring in Young People.—Some of these instances in young girls are associated with imminence of the catamenia, or imperfection in its development. He considers too that some cases in boys are associated with disturbances of the genital system. In the latter cases, the condition usually passes off with adolescence, in the case of girls, it may persist to the age of 20 or 25.

Painless Effusion in Adults and Old People.—These may occur at the climacteric, especially when uterine disorders exist, and such cases must be treated by treating the pelvic disorder. Others are met with in cases of chronic alimentary disorder, which Bennett believes to be the result of auto-infection.

These effusions are also sometimes met with in anæmia.

THE TREATMENT OF GONORRHŒAL AFFECTIONS BY A SPECIFIC ANTI-SERUM.

John Rogers and John C. Torrey : *The Journal of the American Medical Association*, September 14, 1907.

These authors have continued their investigations upon this point, and claim now to have obtained a serum which exercises

a specific curative influence on a high percentage of cases of gonorrhœal affections of certain types. They have satisfied themselves that the serum has not an antitoxic action, and incline to the belief that it brings about the destruction of the gonococci in the tissues possibly as a result of the presence of specific immune bodies in the serum injected, and perhaps also the curative action is aided by an inflow of exudate containing leucocytes produced by the destruction of gonococci and liberation of their endotoxins.

The complications, which they believe to be amenable to treatment, are :—

(1) Those arising by direct extension from the primary focus ;

(2) Those due to a blood or lymphatic infection.

It is singular, however, that the primary urethritis, or vaginitis, and the conjunctivitis are not amenable. Mixed infections, accompanied by suppuration, require surgical treatment.

The serum is given in small doses of 2 c.c., and the agglutination test is looked upon, in its preparation, as a valuable index of its potency. Sheep serum is employed because it has been found free from the toxic properties, which sometimes exist in rabbit's serum. Even with sheep serum there may be some local reaction at the site of inoculation. The injections are given every other day subject to the condition of the patient.

The authors publish some striking examples of recovery under this treatment.

A REVIEW OF OTOLOGY.

By RICHARD LAKE, F.R.C.S.,
Surgeon, Royal Ear Hospital, Soho.

THE past year has not seen so many papers of interest speaking aurally, as usual, but there is a much more marked tendency for the production of papers dealing with the more abstruse problems of otology in our medical press.

As a natural corollary, it is to be noted that, almost without exception, the aurists in the British Isles have ceased to expect that a mastoid operation shall be followed by a complete restoration of the hearing. Such a result can only be arrived at, as a general rule, by operating under conditions which would not appear to be justifiable to the majority of aurists.

Dr. MILLIGAN (Brit. Med. Assoc., 1907) opened a discussion on the treatment of chronic suppuration of the middle-ear without recourse to the complete mastoid operation. He said that many considered that there was too great a readiness to undertake surgical measures without having given local therapeutics a fair trial, whilst others are of opinion that, in chronic suppurative disease, surgical measures should be resorted to even earlier than is at present customary. Clinical, histological, and bacteriological examination shows when the disease has become chronic. Chronicity is evidenced by the decreasing number of leucocytes in the discharge, which still remains fairly copious. Chronic disease might be divided into septic and tuberculous. In the treatment the first essential was free drainage. He was in the habit of making two incisions through the existing perforation, and aspirating the contents of the middle-ear through a Siegel's apparatus. He did not advise the removal of granulation tissue, unless it was present in such amount as to interfere with drainage, as doing so served to open up fresh channels of possible infection. Irrigation by means of the Eustachian catheter was a useful procedure in skilled hands. He emphasised the importance of attention to conditions of the nose and naso-pharynx, and of nasal accessory sinuses; carious teeth should also be removed. He pointed out the important part played by the nasal sinuses in the production and extension of purulent disease of the middle-ear. Treatment should be based upon a detailed

examination of pus from the infected region, which should be bacteriologically and cytologically examined, the characteristics of the cellular elements being first taken into consideration, and subsequently the bacteriological findings. He believed the most virulent organisms present in these cases were diplococci, and next to them the streptococcus pyogenes, staphylococci though common, being of less virulence. It should be borne in mind that cytological examination sometimes demonstrates chronicity at a comparatively early stage of the disease, but more than one examination is advisable before coming to a definite conclusion as to operation. Conservative methods of treatment might be classified as wet and dry. Where the discharge was profuse he recommended frequent and copious irrigation, with the subsequent installation of antiseptic lotions, of which he preferred carbolic acid, though preparations of boracic acid were also useful; an occasional variation in the drug employed was sometimes beneficial. The dry method might be serviceable in cases in which drainage was good, and discharge not profuse. The unsatisfactory results of local treatment in epitympanic suppuration had led to the introduction of operative measures, such as ossiculectomy and curetting, but, in severe cases, Dr. Milligan is convinced that the only treatment of permanent value is the modified mastoid operation, especially when intracranial disease is present. In his experience, both in hospital and private practice, the benefit from ossiculectomy had not been permanent, though the immediate results were in most cases excellent. Lake recorded favourable results in 42 out of 50 consecutive cases, but admitted that, in a certain proportion of these, there was liability to recurrence. Bier's method, though giving good results in acute septic middle-ear disease, had not been successful in chronic cases, partly owing to a bad selection of cases. He referred to the gonococcal form of otitis media. He considered that, in these cases, no time should be lost in opening up the middle-ear and securing free drainage. In a few cases of chronic tuberculous mastoid disease, Koch's tuberculin had been found beneficial. Operations in these cases were generally contra-indicated, retro-auricular drainage being the only procedure likely to be of service.

MR. HUNTER TOD: *Case of primary tuberculosis* of the

left mastoid process, with history of measles four months previously, followed by abscess behind left ear. On admission to hospital, there was a swelling the size of an orange over the left mastoid and purulent discharge from the left ear. On exploration the swelling was found to consist of soft granulation tissue, which could be scraped away. Microscopically, it showed the presence of groups of round cells, containing giant cells. Subsequently, a complete post-aural operation was performed, and soft and pale granulations and carious bone removed from the tympanic cavity, attic, antrum, and mastoid. There was no glandular enlargement. The clinical appearance of the bone removed suggested tuberculous disease. Three weeks later, the opsonic index for tubercle was 0·5.

S. MacCuen Smith (Med. Assoc., Toronto, August 1906): *The Pathogenic Influence of Aural Lesions in Systemic Disease.*—The mouth and aural passages are often the points of entrance of pathogenic micro-organisms, these areas being specially adapted for the cultivation of low forms of life. In 100 autopsies on infants, Ponfick found only nine with no aural disease. In 81,646 cases of aural disease, reported by Hessler, death was due to intracranial disease in 116, to meningitis in 40, brain abscess in 28, and sinus phlebitis and pyæmia in 48, while 99 per cent. of those affected with broncho-pneumonic foci had otitis media. The micro-organisms usually present are Fraenkel's pneumonia diplococcus, streptococcus pyogenes, staphylococcus albus and aureus, and Friedlander's pneumobacillus. Gonococci have also been found in pus in the ears of the new-born. Otitis media is common in many acute infectious diseases, and in some chronic ones, as tuberculosis and syphilis. It also occurs in diabetes and Bright's disease, and, occasionally, in puerperal fever and endocarditis. Septicopyæmia is the chief systemic condition resulting from aural disease. Its pathology includes changes in the primary diseased ear, and secondary changes in various organs and tissues from septicopyæmic metastases. Jürgensen divides the symptoms into five groups:—(1) Cases in which the general phenomena are most prominent; (2) Those in which cardiac implication is most prominent; (3) Predominant implication of bones and joints; (4) Predominant inflammation of skin, subcutaneous connective tissue, and muscles, extending to mucous and serous membranes; (5) Predominant inflammation of internal organs. The

important symptoms as regards differential diagnosis are inflammation of bones and joints, cutaneous eruptions, nervous symptoms, and ophthalmoscopic findings. These are described in detail. The diagnosis may be exceedingly difficult, and that from acute rheumatism, malaria, acute miliary tuberculosis, enteric fever, and uræmia is considered. Cases are quoted, showing the importance of a routine examination of the ear in all cases of illness, in which the diagnosis is doubtful. The writer believes that idiopathic infantile meningitis is a rare condition, and that the majority of such cases are of aural origin. He emphasises the value of the blood count in determining the severity of infection, and concludes (1) marked leucocytosis, with relative percentage of polynuclear cells below 70, shows slight infection, with good resistance ; (2) marked leucocytosis, with relative percentage of polynuclear cells above 80, severe infection, with good resistance ; (3) slight or absent leucocytosis, with relative percentage of polynuclear cells above 80, severe infection, with impaired resistance. Pus is uncommon with less than 80 per cent., except in children, when it may be found with 73. Above 93 per cent. shows a very severe process, while 95 per cent. may be considered almost fatal.

Pus from the ear, presenting anteriorly to the ear, is a very unusual circumstance. Henfford, of Omaha, reports two cases, one obviously of mastoid origin, in the other, the cells were "not involved to any extent." Occasionally, also, pus will be found anteriorly connected with meatal abscess of the anterior wall.

Ossiculectomy has been again brought before the profession, by Dr. Syme, although, as will be seen, he has nothing new to bring forward, as was stated at the British Medical Association. Most of those who were the earlier advocates of this procedure have ceased to employ it as often as formerly ; still there are undoubtedly cases in which it is most useful.

Ossiculectomy in the Treatment of Chronic Suppuration in the Middle Ear.—W. S. Syme, *Glasgow Med. and Surg. Jour.*, June 1907. This operation, which had fallen into disrepute, on account of its unsatisfactory results, had lately regained some credit, notably by the work of Neumann, of Vienna. As now performed, with his adaptation of local anæsthesia, the name otectomy would appear preferable. For the removal of the attic wall, Dr. Syme employs a long narrow

chisel, and he emphasises the fact that the operation is not free from danger. The performance of otectomy though a post-aural incision has been recommended, but this does not appeal to the writer. The most favourable cases for this method of treatment are those, in which the amount of discharge can be sufficiently accounted for by the focus of disease actually observed. Next comes those, in which there is a perforation in the anterior part of the membrana propria, with little discharge and little or no granulation. As regards the influence on hearing, it is difficult to see how there can be any difference between this operation and the radical mastoid.

Aural complications in influenza have already been before the readers of this journal, but a short note of Mr. Cheatle's paper will be of value to those who were unable to give it their attention, and in addition a case is quoted as an example of otitis media, with symptoms suggesting a meningeal infection.

Aural Complications of Influenza.—A. H. CHEATLE: THE PRACTITIONER, January, 1907, p. 104. The middle-ear complications may be non-suppurative or suppurative. The non-suppurative resemble those occurring as a result of ordinary catarrh, but the acute suppurative inflammation is of extreme violence. In any cases, recovery takes place without further trouble, but, in some instances, there is rapid extension of infection, with great destruction of bone, rendering an operation necessary, sometimes within a few days of the onset of the attack. Meningitis or cerebral abscess may result from conveyance of infection by the veins and their coverings, without direct extension of caries. The symptoms of this antral empyema, and the various sites, at which perforation may occur, are described. The writer emphasises the importance of early and prompt treatment, and immediate operative interference, if symptoms of extension appear. The diagnosis between intracranial complications of middle-ear inflammation and symptoms, due to systemic influenzal infection, can sometimes only be made after an exploratory operation. Suppuration may extend from the middle to the internal ear. Extension to the labyrinth is characterised by vertigo, tinnitus, necrosis, profound deafness and vomiting. Symptoms, which are usually unilateral, indicating neuritis of the auditory nerve, sometimes accompany influenza. In these circumstances, the treatment

should be by rest in bed, with plugging of the ear, so as to ensure functional rest, blistering behind the ear, purging with calomel, the administration of bromides in the early stage, and of iodide of potassium in the latter one. In some instances there is a gradual deterioration of hearing power of both sides, with no other symptoms than an attack of influenza. It is supposed that this may be due to a chronic auditory neuritis, but it may be central in origin. Treatment in these cases is unsatisfactory, but rest, change of air, counter-irritation, with the administration of iodide of potassium and an occasional course of strychnine or phosphorus, may be beneficial.

Dr. H. Tilley (British Otological Society): Influenza complicated by Acute Suppurative Otitis Media, with grave Cerebral Symptoms. The general symptoms of influenza subsided in about a fortnight, but the aural symptoms persisted, with severe pain over the right temporal region and the top of the head. On operation, pus was found in the mastoid antrum, a small suppurating track leading backwards from it to the upper end of the lateral sinus, which was exposed and found healthy. On puncturing that part of the temporo-sphenoidal lobe, lying above the roof of the tympanum, about two drachms of pale straw-coloured fluid escaped. Uninterrupted recovery followed. The case was presumably one of serous meningitis, which might have recovered without operative interference. Dr. Tilley did not perform lumbar puncture, owing to its being an emergency case.

Mr. MacLeod Yearsley: Influenzal Otitis Media; Operation; Recovery. The radical mastoid operation had been previously performed on the left ear. There was a history of influenza six weeks before consultation, with otorrhagia on the right side, and since this time there had been slight fœtid discharge, with occasional pain and deafness. When seen, the patient complained of frontal headache and general vertigo, but there was no vomiting, nystagmus, ataxia, or optic neuritis. Cerebration was good, and also sensation, and the reflexes in the lower limbs. The right mastoid antrum was explored, and several foci of carious bone scraped away. A little straw-coloured fluid escaped from the dura, which was bulging and not pulsating. The sinus was healthy. There was uninterrupted recovery, with considerable improve-

ment in the hearing power.

As an example of one of those hardly to be explained conditions of intracranial lesions, which occasionally follow influenza, a case detailed by A. B. Bennett, of Washington, in *The Medical Record*, April 13, 1907, may be taken.

The patient had to commence with severe earache, bilateral, with considerable deafness; a week's treatment improved his hearing and removed the pain, but within a month he was seized with severe headache, nausea, and vertigo, with subnormal pulse and temperature.

No indication was found for operative interference; these conditions remained for another three weeks, when his temperature suddenly rose to 101°.

Both mastoids were opened, and, on the left side, there was very extensive disease of the bone, and the dura was exposed. The patient never rallied, but died shortly afterwards, the highest temperature being 105°.

At the post-mortem, general basic meningitis was found, together with thrombosis of both lateral sinuses, the left was recent, but the right apparently older.

Differential Diagnosis between Ménière's Disease and other Cases exhibiting Ménière's symptom-complex. T. W. PARRY, *B.M.J.*, *May* 11, 1907.—Ménière's disease is rare, while cases exhibiting Ménière's symptoms are by no means uncommon. The following table shows the points of difference between the two conditions:—

Ménière's Disease.	*Other Conditions simulating it.*
Occurs in subjects with normal auditory apparatus.	Occurs in patients with previously affected auditory apparatus.
Sudden onset.	Gradual onset.
Auditory nerve deafness.	Deafness not an essential.

In both conditions, tinnitus, vertigo, and vomiting occur.

The differential diagnosis is established on:—(1) History as to onset of symptoms, etc.; (2) Tuning-fork tests as to whether the deafness is of nerve origin or not. The writer classifies cases giving rise to Ménière's symptoms as, I.—Primary labyrinthing lesions or irritation from (*a*) acute exudation or sudden hæmorrhage into labyrinth (true Ménière's disease); (*b*) chronic labyrinthine sources of irritation; II.—Labyrinthine

disturbance from extra-labyrinthine causes. In his experience, the insertion of a seton, remaining *in situ* for a prolonged period, had had beneficial results in Ménière's disease.

S. von Stein, of Moscow, has recently published deductions made from a series of investigations upon the effects of labyrinthine suppuration upon the muscles. The investigations were, some of them, made by means of two new instruments invented by von Stein, viz., a universal dynamometrograph and a new ergograph.

The conclusions are—(1) the loss of one labyrinth diminishes the force and capacity for work of the flexors of the hands on the side of the lesion, and also exerts the same influence upon the other side; (2) simple pressure on the external (membranous) semicircular canal does not materially influence the powers of the flexors of the hands.

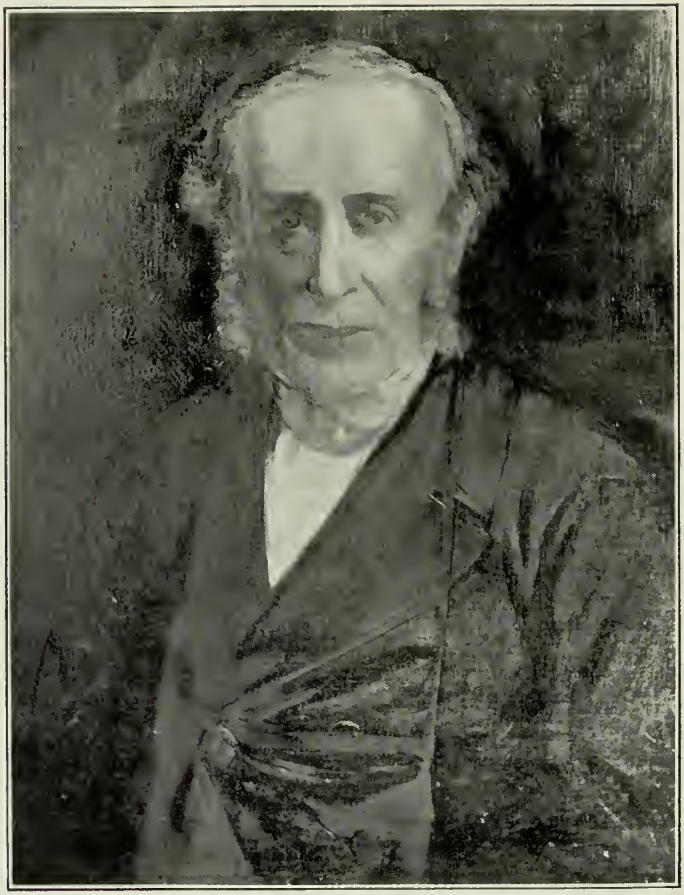
When there is an affection of a certain part of the labyrinth one does not obtain, with the eyes closed, the ergotetanic curve.

Arteriosclerosis of Labyrinth and Acoustic Centres.—*Escat. Ann. des Mal. de l'Oreille, &c.*, 1906. The writer classifies the clinical types of auditory arteriosclerosis as (1) characterised by deafness, but no vertigo; (2) by vertigo, but no deafness; (3) by deafness and vertigo. The conditions, which give rise to the greatest difficulty in connection with the diagnosis of labyrinthine arteriosclerosis, are otosclerosis, beginning in the labyrinth and labryinthine symptoms in connection with renal lesions, especially if the former occurs at a time of life when the arteries may be affected. In the latter case, the diagnosis is comparatively easy, where the condition of the kidney is not arteriosclerotic. In all three clinical types, labyrinthine arteriosclerosis may be the first evidence of arteriosclerosis. In the third type, the prognosis is most grave from the aural point of view, but less so as regards danger to life than in the two preceding types. The treatment divides itself into that of arteriosclerosis and that of the labyrinthine symptoms. Comparative histology has received a further contribution from Dr. Gray, to whose researches we have referred before.

A. A. GRAY, *Jour. of Laryngol. Rhin. & Otol.*, Aug. 1906. From examination of the internal ear in sixteen mammals the writer has been able to differentiate three main types:—

(1) From differences in the shape of the cochlea; (2) From differences in size of perilymphatic space of semicircular canals; (3) From difference in size of otoliths. The sharp-pointed cochlea is found in the carnivora and rodents, and the flattened in man, monkeys, lemurs, ungulates, and cetacea. In the case of the carnivora, the seal is an exception to the general rule, its cochlea being bowl-shaped. A peculiar type of cochlea is found in monotremes. In the human subject, the perilymphatic space is large and well developed, but, in this respect, man is an exception to the general rule, it being usually very small or completely absent in mammals. Other exceptions are monkeys and seals. It is probable that there was a well-developed perilymphatic space in the primary type of mammalian labyrinth, and it may, in the light of our present knowledge, be regarded as indicating a more ancient type. The possession of this space by such a recently developed series of animal as man merely means that man's progenitors have not dispensed with it, when other species of mammals were in process of losing it.

The value of the presence or absence of this space, as a guide to the relationship of different orders and species of mammals, is increased from the fact that it does not appear to possess any physiological function, and may apparently be retained or dispensed with according to the necessities of the case. The labyrinth of one of the monotremes is now being examined in this connection. It has been assumed that the otoliths of mammals are small, owing to the fact that they are so in man, but the writer has discovered that those of the porpoise, seal, and kangaroo are exceptions to this rule. He describes in detail the labyrinths of the lion, the Indian gazelle, the three-toed sloth, and the kangaroo among animals; and the crested screamer and ostrich among birds. In the sloth, the canals are quite unlike those of any other mammal which the writer has examined, the posterior and superior being quadrilateral in shape. It is an interesting feature in the canals of the ostrich, that there is no communication between the posterior and horizontal canals at the point at which the arch of the latter passes under that of the former, there being a distinct though narrow interval between them. As far as present investigations have shown this feature is unique in birds.



JAMES SYME.

LEADERS IN MODERN MEDICINE.

V.—JAMES SYME.

[With Plate XVII.]

It was remarked, by one of his contemporaries, skilled in the use of language, that Syme never wasted a word, a drop of ink, or a drop of blood. The story of his life shows very clearly that he certainly never wasted an opportunity, and, moreover, if such was not present, never hesitated to make one. The end he set himself to accomplish was success as a practical surgeon. To this one object he brought to bear an unfaltering determination, absolutely proof against the slings and arrows of outrageous fortune, and an unusual measure of self-reliance. At the very outset of his career, the obstacles in his path were many and, to all appearance, quite insurmountable ; formidable enough, indeed, to have daunted the stoutest heart. But with a courage which each new danger and every disappointment only served to stimulate afresh, not only did he win through to the lesser eminence of his ambition, but he reached a still higher pinnacle, and enshrined his name amongst those of the foremost pioneers of his Art. And yet Syme's name is not remembered in connection with any special gains in the knowledge of disease, but as essentially a utilitarian of the highest order. He was not a great genius, in fact not a genius at all, but he was gifted with remarkable powers of penetration and continuity of thought, and confidently, but warily, pursued a path, which was always sure, and always led to success. He was a great surgeon, but he never obtained the reputation of being fond of the knife, in spite of the fact that, in medicine, he held aught else but a knowledge of practical surgery at a very cheap rate. He was a still greater clinical teacher, loving his work, and for it being loved, for despite his shyness, his reticence, his slight stammer, and his rooted and outspoken aversion to anything like stupidity, he compelled, and ever held, the reverent affection of all his pupils from the beginning to the end of his career.

James Syme, the second son of John Syme of Cartmore and Lochore, in the "kingdom of Fife," was born in Edinburgh

on the 7th November, 1799. His education was chiefly received at the old High School of Edinburgh, a building which afterwards became part of the Surgical Hospital, in which he treated patients for nearly 40 years. From his earliest years, his proclivities were directed towards biological pursuits and chemical experiments, in which he was joined by his life-long friend Christison. His intense love of flowers showed itself when speechless on his death-bed. When about seventeen years old, he discovered the solubility of india-rubber in coal-tar, and also the waterproofing of cloth by the application thereto of this solution. This was the process subsequently patented by Charles Mackintosh, who gained thereby the large fortune which might have been Syme's, but that his scruples, as an expectant member of a learned profession, forbade him to be connected with a patent. He entered the University of Edinburgh in the year of Waterloo, and began the study of anatomy under Dr. John Barclay, a well-known and excellent anatomist, formerly a "stickit minister." Syme in those days evidently thought little of lectures, for his attendances were desultory and interrupted, in fact he never attended at all the course of lectures on surgery. His work at anatomy, perhaps because congenial, must have been very thorough, for, in 1818, when only 19 years of age he was put in charge, as demonstrator, of Robert Liston's dissecting-rooms. Liston, to whom Syme was second cousin, was then coming into his kingdom of fame as a surgeon.

In 1820, Syme undertook the responsible but dangerous duties of house-physician to the Fever Hospital, and narrowly escaped closing his career altogether by an attack of typhus. In the following year, he became one of the four resident-clerks in the Royal Infirmary, whose duties are now carried out by house-physicians and house-surgeons. Here, as before at the Fever Hospital, he allowed no opportunity of gaining practical knowledge to escape him. In both these appointments, he was continually employed in bleeding patients, the indiscriminate practice of which disgusted him. He referred to the horrible experiences he had witnessed in those days in his address on Surgery, in 1865, at the meeting of the British Medical Association in Edinburgh. In 1821, he became a Member of the English College of Surgeons, and proceeded to

Paris in the following year to study anatomy and operative surgery. Returning thence he became solely responsible for Liston's anatomical rooms, and began a regular course of lectures on anatomy. During the year, he took the F.R.C.S. Edin., soon after which occurred a grievous quarrel with Liston, which remained unhealed for many years, and which, moreover, threatened absolute shipwreck to all his hopes of a successful career, which up to that time were growing more and more promising. Black as was the prospect, he rose to the occasion, and brought his tenacious and unbending determination into full play. He continued his anatomy lectures, and spent part of the following year studying surgery in the medical schools of Germany. In 1825, he gave up lecturing on anatomy, but not the studying of it, for this he kept up to the end of his life, and turned his whole attention and energy to surgery, with complete confidence in ultimate success. The odds against him were enormous. Liston was at the height of his fame in Edinburgh, and while he remained on the staff of the Royal Infirmary, no appointment to the Infirmary—the only means available for his life's purpose—could possibly come to Syme. There were also formidable and well-placed rivals. Lizars had acquired a name for boldness and originality. Turner, Allen, and Munro were all practising and lecturing on surgery, while Fergusson was coming on behind. Except the last-named, all these were men of assured positions of some years' standing, while Syme was young (under 30), almost unknown, with a practice still to make, and with the hand of the leading surgeon of the day heavily against him. It is one of the strangest stories on record, but by dint of "setting a stout heart to a stey brae," Syme conquered in the end. First he formed a sort of partnership with Dr. Mackintosh, and started classes, lecturing himself on systematic surgery. His class rapidly increased in numbers, and, in one year, contained 250 members. He continued at this work for four years with a growing reputation. In 1829, he failed once more to get an appointment to the Infirmary, and as a hospital appointment was absolutely indispensable to him, he determined to start a hospital of his own. For this purpose, he took on lease Minto House, a large house close to the University and the Infirmary, containing 15 rooms. Into

this he put 24 beds, and opened an out-patient department. The rent was high and the expenses heavy, but with that absolute self-reliance, which was one of his great characteristics, he looked entirely to himself as sufficient support, reckoning confidently upon obtaining so much from students as fees, so much from the resident house-appointments, and very little from the general public. In two days, 10 men had applied for the house-surgeons' appointments, although the board cost £100 a year. Patients came in plenty for treatment, both as in- and as out-patients, and here Syme began that system of clinical instruction, which was the great feature of his teaching, and by which he became most famous. In the first year of its existence as a hospital, Minto House was visited by 1,900 out-patients, received 265 as in-patients, and 95 operations were performed. It proved a great success, and students' fees flowed in, among them those of the genial author of *Horæ Subsecivæ*, who was very proud of the fact that it was his fee that purchased for Syme his first carriage—a gig—for which "John" was rewarded by being taken out for the first drive in the new cart. Syme's lectures at Minto House were recognised by the English College, but not by the Edinburgh authorities. Here for four years was the extraordinary spectacle of a busy hospital and school, entirely run by a young man of thirty, which rivalled the Royal Infirmary itself in the variety and importance of the operations performed. Here the sterno-mastoid was first divided in a case of wry neck, here was performed the work upon which was based the book, published in 1831 (his first), on *Excision of Diseased Joints*, and here was the scene of that most pathetic incident in *Rab and his Friends*. It was as a result of his work at Minto House that Syme was able to concentrate his broad and philosophical views of the principles governing surgical practice, which he embodied in the *Principles of Surgery* published in 1832. This book supplied a much-felt want, and ran through five editions. It is clear and concise, but is Syme *et præterea nihil*, for he read very little of other men's works, preferring to learn everything at first hand, and he was too much given to thinking that his own improvements in any particular direction—and they were many—settled the matter beyond further question. The book is decidedly remarkable

in one way, in that the last edition in 1863 is smaller than the first. *O! si sic omnia.*

He suffered yet another disappointment in 1831, for though his friends managed to save from extinction the post of Professor of Surgery at the College of Surgeons, vacated by Turner on appointment to the newly-created chair of Systematic Surgery in the University, Syme lost the appointment by one vote. He had not long to wait, however, for, in 1833, the walls of his Jericho at last fell down by reason of his appointment by the Crown to the chair of Clinical Surgery in the University, in succession to Russell. This professor had reached the ripe age of 83, and was willing to retire on condition of receiving from his successor £300 a year as pension. This sort of arrangement was apparently not at all uncommon in Edinburgh in those days, and Syme agreed to it without hesitation when the suggestion was brought to him, for it placed securely within his grasp the summit of his ambition—a permanent appointment on the staff of the Royal Infirmary. The managers of the Infirmary were now compelled to give him accommodation in order to carry on his lectures, which the students of the University were obliged to attend as a qualification for graduating. Liston left Edinburgh in the course of the following year for London, where he had accepted the post of Professor of Clinical Surgery at University College Hospital, and as Fergusson had already gone south to King's College Hospital, Syme was left practically supreme in Edinburgh, and from this time onwards for nearly 40 years, with one short break, he absorbed by far the largest share of operative surgery in Scotland. In 1837, he carried out his experiments showing the function of the periosteum in the repair of bone. In 1838, he was appointed Surgeon in Ordinary to Her Majesty in Scotland. In 1842, he performed for the first time his amputation of the foot at the ankle-joint as a substitute for amputation below the knee, up to that time the recognised practice in disease of the tarsus. The operation was quite new and entirely his own, but was not described in print until 1847. By removing the site of the operation farther away from the trunk, Syme made it less dangerous; all the diseased part of the foot could be removed, the whole of the leg was saved, and the patient obtained a stump, upon which he could rest the whole

weight of his body. "It is," says Joseph Bell, "unrivalled in perfection of principle, applicability, and success." It is quite impossible to estimate the number of legs—and, as a necessary corollary, lives—which have been saved by the introduction of this amputation. His own share was not less than 50. The operation remains, and will always remain, the only one of real value in surgery of the foot. Modifications have appeared from time to time, the success of which has been chiefly to vex the soul of the examinee in operative surgery, since their practical utility in the living subject has proved to be of no avail.

And now came the most remarkable episode in Syme's life, and probably the most unique in the whole history of Scotland. A Scotsman leaves his native heath to settle in London, but, after a short experience, shakes the Southron dust from off his feet, and re-settles himself in his own country.[1] In 1847, on the death of Liston, the authorities of University College Hospital invited Syme to fill the vacant chair of Clinical Surgery. Sharpey, one of his old friends, had been for some time at University College, and warmly pressed him to accept the invitation and come south. It meant, of course, giving up a great deal in the way of emoluments, but the invitation was flattering, and an opportunity for a larger field of work seemed to be opened out. Syme accepted, stipulating at the same time that he should not be required to undertake the drudgery of lecturing upon Systematic Surgery in addition to Clinical Surgery. He was duly appointed Surgeon to University College Hospital and Lecturer on Clinical Surgery, and came to London in February, 1848. He was received in London with courtesy, but with caution, for his infirmity of temper was known, and also his unhappy propensity of failing to recognise other men's work in the same field as his own. He secured from the first the enthusiastic devotion of the students, for, apart from his attractiveness as a teacher, he was throughout his life the students' friend, and always took their part in any discussion concerning them, openly scoffing at much they were required to learn and at the methods adopted for teaching. Students knew they could trust him implicitly, and that once in his good books, they were sure of his friendly offices in any

[1] An atrabilious friend laments that, so far as the medical profession is concerned, the incident is and remains *sine prole*, for in his opinion it is fully worthy of a large measure of that which is the sincerest form of flattery.

difficulty. His London experiences, however, except with the students, did not prove at all happy, for he soon found himself in collision with his colleagues, many of whom were his fellow-countrymen. In Edinburgh, he was pre-eminent, knowing and being known by everybody of standing, social and professional; in London, he found himself, as it were, merely one in a crowd. He was now verging on fifty; and, in the season of the sere and yellow leaf, fighting one's way through a crowd has, like football, lost the attractions that made it a pastime in early years. Any coign of vantage, though it may not be quite in the front row, is preferable, for buffets and kicks make more impression and leave behind more painful and more lasting bruises, even in the case of the most combative. Syme felt that he was in a smaller and inferior position to his former standing and that he had made a mistake. It required a great deal of moral courage to resolve to "cut his losses," but when, in May, 1848, the authorities of University College requested him to lecture upon Systematic Surgery, he promptly seized upon this as a valid excuse for resigning, and July saw him back again in Edinburgh, rejoicing at regaining the beauties and pleasures of the highly treasured gardens at his house at Millbank. Once back, he practically picked up again the threads of his life where he had laid them down. His old chair was still vacant, and the University and other authorities were only too glad to get him back, and re-instal him in all his former positions. His election shortly afterwards to the Presidency of the Medico-Chirurgical Society of Edinburgh testified to the welcome of his own profession, that office being the highest honour within their power to bestow. From this time forth, his life was full of work and some of his boldest operations were performed. He took up the subject of "Medical Reform," throwing himself into it with fervent enthusiasm. In 1859, he was elected as representative for Edinburgh and Aberdeen Universities to the General Medical Council, upon which he soon exercised considerable influence, and to him is due the beginning of the valuable work of the Educational Committee of the Council. Ever a fighter from his youth up, he was engaged in many controversies, some indeed being carried into the courts. "He was almost always right in matter, sometimes wrong in manner" (Dr. John Brown).

In 1857, he incised and ligatured a traumatic aneurysm of

the carotid, and, in 1859 and 1860, he dealt in like manner with a couple of large axillary aneurysms. In 1862, he cut into an iliac aneurysm and tied the common, the internal, and the external iliac arteries. In the same year he excised the whole tongue for cancer. In 1867, he published his 35th case of ligature of the superficial femoral for popliteal aneurysm, all of which cases were successful. Visiting Dublin this year, he was made an Hon. M.D. In 1868, Thomas Carlyle came to Millbank and was operated on there. The dyspeptic sage expressly excluded Syme from his sweeping condemnation of doctors, and one can but regret that Syme's professional horizon was bounded by practical surgery. A little wholesome medical advice at this time might perhaps have done something to abate the great man's infirmities in health and temper. Imagination gasps at the thought of what an eupeptic Carlyle might have wrought. In 1869, came the M.D. from Bonn University and the D.C.L. from Oxford, while Syme was engaged in his last and most strenuous contest, the "Battle of the Sites." This raged with respect to the new site for the Royal Infirmary; and Syme fought with more than his customary vigour and incisiveness with tongue and pen for the removal of the infirmary to the site occupied by George Watson's Hospital, where was ample room. He utterly routed the opponents, and thereby earned the enduring gratitude of posterity. Suddenly, on 6th April of this year, he was struck down at his chambers in Shandwick Place by hemiplegia. He was still in his prime and was about to be elected President of the General Medical Council. In July, he resigned his professorship and his appointment to the infirmary. It was a bitter grief to him to be obliged to give up his dearly-loved teaching, and his equally-loved practical work, but he accepted the warning. He did not give up practice altogether, for he continued for some months to see patients at his consulting rooms. The occasion of his resignation called forth deep sympathy from all parts of the world, and this took practical shape in a testimonial from his old pupils, which was so largely supported that the "Syme Surgical Fellowship" was established as the result. In the spring of 1870, he had another seizure, which left him speechless, and he died at his beautiful home, Millbank, on 26th June.

Lord Lister, his son-in-law, wrote the obituary notice in the

Scotsman, in which occur the following estimates of his work. "His early papers on the nature of inflammation; his views in his *Principles of Surgery* on the 'disturbance of the balance of action' in the system in relation to the cause and cure of disease; his beautiful experiments demonstrating the function of the periosteum in the repair of bone; his plan of leaving wounds open until all oozing of blood had ceased, adopted by and often attributed to Liston; his constitutional treatment of senile gangrene; his treatment of callous and specific ulcers by blistering; the introduction into Britain of excision of the elbow in spite of powerful opposition; the amputation, which bears his name, at the ankle-joint, and which has superseded in most cases amputation of the leg; his improvement in plastic surgery and more especially in the repair of the lower lip; his discoveries in disease of the rectum, previously an obscure subject; his treatment of stricture of the urethra by external division, and his bold and original method of grappling with some of the most formidable kinds of aneurysm; his additions to the mechanical instruments and appliances of his art; such are some of his many labours and serve to illustrate their great variety and extent." Dr. John Brown closes his tender tribute to his master and friend in *Horæ Subsecivæ* by another quotation from Lister's panegyric. "Mr. Syme may be said to have been as a surgeon 'in all supreme, complete in every part.' In clear perception and luminous exposition of surgical principles, both pathological and practical, he stood unrivalled; yet he was equally conspicuous for the correctness of his diagnosis, his originality and ingenuity in device, and his admirable excellence in execution. His success was due not merely to his great intellectual gifts and manual dexterity, but fully as much to his genial sympathising love alike for patient and student, his transparent truthfulness, and his exalted sense of honour. These noble qualities made him keen in the discharge of surgical duty, and influential for good in an immeasurable degree with those who came within the range of his personal teaching."

Our illustration has been photographed from an oil painting by kind permission of the Royal College of Surgeons, Edinburgh. The marks on the plate are due to cracks, etc., on the painting, caused by age.

NOTES FROM FOREIGN JOURNALS.

DIET IN TUBERCULOSIS.

Lannelongue and Achard recently reported, at the *Académie des Sciences*, the results of some experiments on the influence of foods on the course of experimental tuberculosis. In order to obtain some definite information on a question of so great practical importance, 60 guinea-pigs were kept under observation, divided into three equal classes, so that, in each class, the animals were approximately the same weight. All had the same food for 11 days, and being found to be quite healthy, they were then given, on the same day, an uniform dose of one-third of a c.c. of an emulsion of tubercle bacilli into the right pleural cavity. Each class was then given, over and above the ordinary food as before, additional nourishment, one class receiving 9 grammes of butter a day for each, in the second class, each was given 20 grammes of sugar a day, and each, in the third division, had 20 grammes of gluten a day. Each complement corresponded to about 145 calories. The results showed a marked difference. Those taking butter were all dead in 40 days; those having sugar lived for 87 days; while the gluten eaters remained alive for 371 days, just over a year. The authors claim that these experimental facts establish the fact that nitrogen must have a large share in diets ordered for tubercular patients.—(*Revue de Thérapeutique Médico-Chirurgicale.*)

THIOSINAMINE IN DISEASES OF THE EYE.

Dolganov and Levitskaya made use of thiosinamine in 13 cases of atrophy of the optic nerve, at different stages of development, 6 cases of retinitis pigmentosa, and 4 cases of syphilitic choroido-retinitis. Every day, or every second day, a Pravaz syringe-full of the following was injected under the skin:—

℞ Thiosinamin. - - - - ʒj.
Glycerini - - - - ʒij.
Aq. destill. steril. - - - ʒj–ʒiss.

Positive results were obtained, inasmuch as central vision and the extent of the visual field were definitely increased, although in inverse proportion to the gravity and age of the lesions. After leaving off the treatment, the improvement was maintained for several months. No ill-effects, local or general, were noticed attributable to the injections. The value of the observations is somewhat lessened by the fact that injections of strychnine were given alternately with those of thiosinamine.—(*Revue de Thérapeutique Médico-Chirurgicale.*)

SUB-NITRATE OF BISMUTH IN DISEASES OF THE STOMACH.

The *Archives des Maladies de l'Appareil digestif* contain a full account, by Gaston Lion, of the use of bismuth for diseases of the stomach. He insists upon the use of a very pure preparation in order to avoid toxic symptoms. The heavy sub-nitrate is to be preferred to the light, because

the latter very often contains impurities, such as the carbonate or the oxides. Chemically pure sub-nitrate is harmless, as much as 80 grammes (℥xx.) having been taken daily. Its use is indicated in gastric pain, whatever may be the cause, and is equally successful in hypopepsia, apepsia, and hyperpepsia. It soothes gastric pains of all sorts, but is ineffective in those due to nervous dyspepsia. The sedative effects are produced from the second to the sixth day. In simple ulcer, it relieves pain and hastens healing. In cancer of the stomach, only temporary relief is afforded. In bleeding from the stomach, Lion confirms the good effects already noted by Mouneret and Fleiner. It acts as an antiseptic in abnormal fermentations. There is only one contra-indication to the use of bismuth in large doses, which is when, in some part of the alimentary canal, stenosis exists. In these cases, bismuth accumulates behind the obstruction forming a concretion with the mucus. If used in cases, presenting only a slight degree of stenosis, it must be given in small doses, and be watched very carefully. Constipation is no bar to its use, for large doses make the motions more regular, and may even produce diarrhœa. Lion is of opinion that it has a double action on the stomach; physically, by coating the mucous membrane, and thus shielding the glands and nerve endings from the more or less irritating effects of the gastric contents, ulcers being protected in the same way and healing promoted. Chemically, many believe that the salt is not acted upon by the gastric juice, but Lion, as the result of clinical examinations of gastric chemistry, has come to the opposite conclusion. He finds that bismuth, taken either before or with a test-meal, lessens hyperchlorhydria, decreases the pepsine, and reduces the energetic action of the process of digestion. When it is taken with a meal, digestion goes on more quickly, and the stomach empties itself in a shorter time. Bismuth has no direct action upon secretion.

It may be given in the morning, after lavage, in a dose of ℥iiss. to ℥v suspended in ℥vj. to ℥viij. of water. The patient should then lie down on the side corresponding with the presumed site of the lesion. When the protective action of bismuth is wanted, the dose should be given when the stomach is empty, and may be administered by the mouth. By giving a large dose five or six hours after a meal, the contents of the stomach are changed into a solution which is, though acid, not irritant, and the stomach then empties itself with ease.

TREATMENT OF SYMPTOMATIC URTICARIA IN INFANTS.

Scharff prefers this term to strophulus or erythematous urticaria. As the result of several years' experience, he finds that the best way to relieve the pruritus is to apply to the skin a 5 per cent. aqueous solution of ichthyol, to which should be added 5 per cent. of glycerine. This is applied twice a day, and covered with starch-powder. More obstinate patches are treated by a coating of the following preparation:—

℞ Ichthyol.
Amyli - - - - - - āā ℥j.
Ovi Albumin. - - - - - j.
Aq. - - - - - - ℥iiss.
Misce.

In the reflex forms, like that arising from irritation of the erupting teeth,

ichthyol may be given internally, a young infant being able to take, three times a day, 10 drops of a 10 per cent. aqueous solution. There is not, as a rule, any distaste shown for the drug by children, disagreeable as it appears to adults.—(*Therapeutische Monatshefte.*)

GASTRIC ULCER AND NEURITIS OF THE VAGUS.

The views specially put forward by Professor Dubard, of Dijon, with regard to the pathogenesis of simple ulcer of the stomach, have been brought together and considered by Huchon in his thesis at Lyons. Some of the points are of practical use in the diagnosis and prognosis of this disease. Dubard holds that a chronic lesion of the lung will, as a result of the irritation of the nerve-endings of the pneumogastric in the lung, give rise to a neuritis, or neuralgia, of that nerve, which, in its turn, will produce trophic lesions in the stomach leading to gastric ulcer. The same result is produced by a mediastinal tumour and an aneurysm of the aorta. His observations have shown that nearly all cases of gastric ulcer are in patients more or less cured of old tubercular trouble, or in those who are offering good resistance to the disease. In all these cases, if pressure is made in the neck upon the vagus, pain, more or less sharp, is produced. This pain, which Huchon calls *Dubard's Symptom*, is looked upon as evidence of neuritis affecting the vagus, and is constantly present in cases of simple gastric ulcer, but is not found in other diseases, such as cancer, because the lesion is not caused by neuritis of the vagus. This may, therefore, be a means of differential diagnosis easy of application. Dubard insists upon the frequent association of tuberculosis and gastric ulcer, and adduces 15 cases in which he has performed gastro-enterostomy, 12 of which showed distinct evidence of tubercle, either in evolution or cured, but having left its mark in old and now sclerosed lesions of the lung. In all his patients, who have been proved to be suffering from ulcer, one, and in some cases both, of the pneumogastrics have been tender on pressure in the neck. Nothing of the same kind has been observed in cancer. This symptom is by no means to be taken as pathognomonic *per se*, but only when associated with other leading symptoms of ulcers and severe dyspepsias. Many of his patients have suffered, before showing any gastric symptoms, from lung troubles, bronchitis, asthma, palpitation of the heart, etc. In some patients attacks of hæmatemesis have alternated with fits of asthma.—(*Journal de Médecine et de Chirurgie pratiques.*)

TANNIN IN POST-PARTUM HÆMORRHAGE.

In the Vaud, where the women lead very laborious lives, and have very large families, post-partum hæmorrhage, due to uterine inertia, is of very frequent occurrence, and the country practitioner is at times at his wits' end for an effective method of treatment, the usual means—ergotine, massage of the uterus, bi-manual compression, ice, injections of hot water, with or without tannin, and even plugging with gauze or the fist—having failed him. In such a case, Renaud tried the effect of gauze powdered with tannin, and the effect was almost immediate, although the uterine contractions remained very weak. He thereupon had prepared some gauze, impregnated with 10 to 15 per cent. of tannin, which was cut into suitable lengths for

packing the uterus, and then sterilised by high-pressure steam. These are packed in parchment paper, which keeps them aseptic, portable, and ready for instant use. He has made an extensive use of this hæmostatic packing, and has always obtained a successful result, with rapidity and certainty in cases of post-partum hæmorrhage, and also in cases of severe metrorrhagia at the menopause, in which packing has been necessary. As the dressing is "hæmostatic" and not "antiseptic," every care must be taken in introduction to avoid soiling against the labia and external parts of the genital region, and the packing should not be allowed to remain in the uterus for more than from 12 to 20 hours. This allows ample time to ensure firm coagulation.—(*Revue médicale de la Suisse romande.*)

MISTLETOE AS A THERAPEUTIC AGENT.

Recommended by Galen, Pliny, and the older writers for its therapeutical value, and again in the eighteenth century by many physicians for use in chorea, epilepsy, hysteria, and paralyses, this survival of Druidical reverence seems to be on the point of developing a new usefulness. Huchard has a short paper in the *Journal des Praticiens* on the subject, to which he will return, when more extended observations have been made. Payne, in 1882, obtained by experiments the information that extract of mistletoe has an irritant action on the intestines, increases the frequency of the heart's action, diminishes reflex action by paralysing motor and sensory nerves, dilates the pupil, and promotes contraction of the uterus. Deguy, in 1901, used the extract in Huchard's wards in cases of albuminuria, with the result that, in some cases, the amount of albumen passed was appreciably decreased. At last year's Congress of Clinical Medicine in Paris, René Gaultier, who had pointed out, during the previous year, the good effects accruing from the use of extract of mistletoe in the congestive hæmoptysis of tubercular patients, showed, as the result of experiments carried out with Chevalier in Professor Pouchet's laboratory, that the drug has the property of reducing arterial tension. He used the aqueous extract, 2 centig. in a pill, 5 to 10 of which were taken daily, or in a syrup giving 10 to 15 tablespoonfuls a day, or in hypodermic injection, prepared as follows:—

Dried leaves of Viscum album. - - -	10 g.
Boiling distilled water - - - -	200 g.
Pure Chloride of Sodium - - - -	0·35 g.

The leaves are bruised and roughly powdered in a mortar. They are then infused for 12 hours in a third of the water. This infusion is repeated twice, and the resultant fluids mixed together, filtered, and evaporated in a water-bath to 50 c.c. The salt is then added, and, after refiltering, the infusion is sterilised at 120° C. for 20 minutes. One c.c. of this is used for injection in two doses each day.

It is stated that tension is reduced quickly to a marked extent, and persists for some time. If these new properties are found trustworthy and practicable, a notable and welcome addition will be made to the limited class of "hypotensors."

INTRA-DURAL INJECTIONS OF MAGNESIUM SULPHATE IN TETANUS.

Franke reports from Glucinski's Clinic, in Lemberg, the successful treat-

ment of a case of tetanus by Meltzer's intra-dural injections of a 25 per cent solution of sulphate of magnesia. In the course or some days, three injections were made, one of 1 c.c. of the solution, and two of 2 c.c. The tetanic spasms were promptly relieved, and there was marked decrease of sensation in the lower half of the body. This effect only lasted for one day after the injection. The case was one of moderate severity, and Franke admits that recovery without the injections was a possibility. He does not, therefore, attribute the successful result entirely to the method, but considers that in it we possess a symptomatic remedy more satisfactory or use than any other narcotics which have been tried.—(*Zentralblatt für innere Medizin.*)

TREATMENT OF THE DIFFERENT FORMS OF PSORIASIS.

Lecturing at the Hôpital St. Louis on this subject, Brocq first drew attention to the many different aspects presented by what "is not a psoriasis disease, but an eruption with an objective appearance called psoriasis." The ætiological factors are numerous, arthritic, neurotic, syphilitic, tuberculous, and toxic (tea, coffee, and alcohol). Internal treatment was largely trusted to in former days, whereas, at present, its *rôle* is of much less importance. In treating a case of psoriasis, three factors must be taken into consideration in order to determine what must be done locally: (1) the degree of inflammation of the integuments; (2) the position and extent of the patches; (3) the social conditions of the patient.

If the psoriasis is inflamed, use must be made of soothing applications—sapolan, sapolan ointment (5 or 10 per cent.), ichthyol, ointment, dilute coal-tar ointment, or Cuticura ointment. If these prove irritating, the paste of ichthyol and zinc must be substituted.

If the patches are discrete and isolated, plasters of coal-tar, oil of cade, mercurial plasters, and even traumaticine or collodion of pyrogallic acid or of chrysophanic acid may be used, but, in the case of the last mentioned, it is necessary before application carefully to disinfect the skin with spirits of camphor or ether. But however few patches may be present, there must be general external treatment. Treatment must not be confined only to the diseased parts. At night the whole body, and particularly the patches, must be well soaped and washed. After drying, the whole skin must be covered with the ointment selected, more being applied to the patches. Then a thick knitted cotton vest, covering the whole body, must be put on, and the more impregnated with ointment it is the better. In the morning, the ointment must be carefully removed and replaced by an odourless variety, over which goes the day vest. When the eruption has completely disappeared, the treatment must be continued for five or six weeks, in order to prevent a sudden relapse. Afterwards, for some months, the treatment should be carried out once or twice a week. For the hairy scalp, mercurial ointments must be used (yellow oxide or turbith), but it may be necessary to add to these coal-tar or oil of cade for a complete result.—(*Le Progrès médicale.*)

Reviews of Books.

NOTES ON NEW EDITIONS.

A System of Medicine by Many Writers. Edited by Sir Thomas Clifford Allbutt, M.A., M.D., F.R.S., etc., etc., Regius Professor of Physics in the University of Cambridge, Fellow of Conville and Caius College; and Humphry Davy Rolleston, M.A., M.D., F.R.C.P., Physician to St. George's Hospital, and to the Victoria Hospital for Children, sometime Fellow of St. John's College, Cambridge. Pp. 1040. London: Macmillan & Co., Ltd. 25s. net.

This, the third volume of the second edition of this important work, has been practically re-written. Certain articles, such as those by Dr. A. E. Garrod on Rheumatoid Arthritis, Osteo-Arthritis, and other forms of joint affections, are entirely new. It is interesting to note that a clear distinction is here drawn between osteo-arthritis and rheumatoid arthritis. There is an extremely good article, on Pulmonary Osteo-Arthropathy, written by Dr. Batty Shaw. The articles dealing with Gout and Diabetes Insipidus have been revised by Dr. John Rose Bradford. Dr. Still contributes an excellent article on Congenital Hypertrophy of the Pylorus. The article dealing with Gastric Ulcer, written by the late Professor Dreschfield, is one which will commend itself to all interested in that particular subject. Without exception, all the articles contained in this volume are worthy of most careful study, and this system of medicine should be on the bookshelf of every scientific medical practitioner.

Tropical Diseases. By Sir Patrick Manson, K.C.M.G., M.D., LL.D., F.R.C.P., F.R.S., Lecturer on Tropical Diseases at St. George's and Charing Cross Hospitals; Medical Adviser to the Colonial Office, etc., etc. Pp. 876. Seven coloured plates and 241 plain figures Cassell & Co., Ltd. 12s. 6d. net.

During the last few years much excellent work has been done in reference to the diseases peculiar to tropical climates, and much has been added to our knowledge. The present edition, the fourth of Sir Patrick Manson's excellent manual, has been thoroughly revised and brought up to date. It presents, in an easily readable and most interesting form, a complete account of the result of all the most recent work in tropical diseases. The plates are beautifully reproduced, especially the one illustrating the parasites of Kala-azar and of Oriental Sore. The book is especially useful for those practitioners who may be carrying on their profession in warm climates, but all those interested in medicine will do well to study it.

The Operations of Surgery. By W. H. A. Jacobson, M.Ch. (Oxon), F.R.C.S., Consulting Surgeon, Guy's Hospital, and R. P. Rowlands, M.S. (Lond.), F.R.C.S., Assistant Surgeon and Surgeon to the Orthopædic Department, Guy's Hospital; Joint Teacher of Operative Surgery in the Medical School. London: J. & A. Churchill. In two volumes. 42s. net.

Mr. Jacobson's well-known book on the operations of surgery first appeared in 1888, and we now have before us the fifth edition. The book was originally written for the use of those surgeons who had been recently appointed on the staff of a hospital, and also for those senior students who

are preparing for the higher examinations in surgery. That the author was right in the idea which suggested the book there is not the slightest doubt, for Mr. Jacobson's treatise has long been recognised as the best book on operative surgery. In preparing this edition, Mr. Jacobson has had the advantage of the co-operation of Mr. R. P. Rowlands, who has written the sections dealing with the general surgery of the abdomen. The chapters dealing with the "Operations on the Ovary and Uterus" have been thoroughly revised and largely re-written by Mr. G. Bellingham Smith. The book is profusely and clearly illustrated, and will certainly be found to be most useful by those who have to instruct students in operative surgery.

Auscultation and Percussion; together with the other Methods of Physical Examination of the Chest. By SAMUEL GEE, M.D., F.R.C.P., Honorary Physician to H.R.H. The Prince of Wales, and Consulting Physician to St. Bartholomew's Hospital. Pp. 325. London: Oxford Medical Publications. 5s. net.

WE are pleased to see the fifth edition of this well-known little book. It is divided into two parts, the first dealing with physical signs and their meaning, the second, with these signs considered in their relation to the discovery of disease. The whole subject is clearly and well treated, and easy for the reader to follow. We think the author is well advised not to include the X-ray methods of diagnosis, as they would require a great deal of explanation and would detract from the lucidity and simplicity of the work. We confidently recommend this book not only to the student, but to the medical man who wishes to refresh his knowledge of the subject.

Gout; Its Pathology, Forms, Diagnosis, and Treatment. By ARTHUR P. LUFF, M.D., B.Sc., F.R.C.P., Physician to St. Mary's Hospital. Third edition. Pp. 290. London: Cassell & Co. 10s. 6d. net.

WE are pleased to see a new edition of this useful work on gout. The subject is treated in the common-sense way and in the scientific spirit shown in previous editions. One important addition is the discussion of questions relating to the intestinal origin of gout, and the probability that a toxin, absorbed from the alimentary canal, is the starting point of the alteration of metabolism. The author inclines towards a bacterial toxin, but whether this view is correct, or that it is due to some alteration of digestive action or some other cause, further investigations alone can answer. Recent investigations of gastro-intestinal conditions in gout have certainly greatly advanced our conception of the disease. The theory that uric acid is only a by-product in gout is favoured by the author; all recent scientific work has tended to confirm this idea.

We do not care to see the word quadriurate so often used, as the latest investigations indicate that there is no compound of this nature.

In former editions, the chapters on treatment, which, after all, are what the average practitioner reads first, were meagre; but this part of the subject has been extended in the present edition.

We are glad to see that the author gives attention to "irregular gout," and those readers, who have seen much of these indefinite conditions in practice, will understand the importance of this part of the subject. However little we may like the term, no better one has yet been found for those irregular manifestations which are so common nowadays, when acute articular attacks are so seldom met with.

Insanity and Allied Neuroses. By GEORGE H. SAVAGE, M.D., F.R.C.P., late Physician and Superintendent of Bethlehem Royal Hospital, Lecturer on Mental Diseases at Guy's Hospital, with the assistance of EDWIN GOODALL, M.D., B.S., F.R.C.P., Medical Superintendent of the Cardiff City Hospital for Mental Diseases, late Medical Superintendent, Joint Counties Asylum, Carmarthen. Pp. 624. London: Cassell & Co., Limited. 12s. 6d.

THE fourth edition of this excellent manual has been thoroughly revised, and particular attention has been paid to those sections which deal with the pathology of the various diseases. The work contains many new illustrations, and there are also six new coloured plates. In the revision of the book Dr. Savage has had the co-operation of Dr. Edwin Goodall, whose original work and experience have added much to the usefulness of the manual. We especially recommend the work to general practitioners, who may require a reference book, for any mental cases with which they may have to deal. From a clinical point of view the book is particularly useful, for it contains a detailed account of a large number of illustrative cases.

Pathology, General and Special, for Students of Medicine. By R. TANNER HEWLETT, M.D., F.R.C.P., D.P.H., Professor of General Pathology and Bacteriology in King's College, London; Lecturer on Bacteriology, London School of Tropical Medicine; Physician to the Seamen's Hospital, Greenwich, etc., etc. Pp. 585. London: J. & A. Churchill. 10s. 6d. net,

JUST a year ago we favourably reviewed the first edition of Professor Hewlett's book, and now we have the second edition before us. This of itself is sufficient recommendation of a valuable book. The present edition contains an excellent chapter on the female genital organs from the pen of Dr. Frank E. Taylor. There are many additions in the new issue, especially in that portion of it which deals with heredity, inflammation, the heart, and arterio-sclerosis. We especially recommend the work to medical students and practitioners who may be reading for the higher examinations in medicine.

A Short Practice of Gynæcology. By HENRY JELLETT, M.D., F.R.C.P.I., Gynæcologist and Obstetric Physician to Dr. Steven's Hospital; Ex-Assistant Master, Rotunda Hospital. Third edition, revised and enlarged. With 310 illustrations. London: J. & A. Churchill. 12s. 6d. net.

THIS edition has been greatly enlarged and improved, and may now be fairly stated to be a concise, succinct and accurate presentation of up-to-date gynæcological practice. The chapters dealing with operations have been largely amplified, but we miss any allusion to Wertheim's operation for the removal of cancerous uteri. Further, adenomyomata of the uterus are just mentioned under the title of adeno-fibromyoma; no description of this condition is given, and the illustration of it in Fig. 69 is absolutely unrepresentative.

The book is well printed and beautifully illustrated, the sections on gynæcological operations being particularly well illustrated, the illustrations being taken, for the most part, from well-known sources.

Medical Lectures and Aphorisms. By Samuel Gee, M.D., F.R.C.P., Honorary Physician to H.R H. the Prince of Wales, and Consulting Physician to St. Bartholomew's Hospital. Pp. 307. London: Oxford Medical Publications. 5s. net.

The second edition of Dr. Gee's *Medical Lectures* and well-known aphorisms is very welcome to the medical profession. We recommend all general practitioners to obtain this useful little volume, and to read it at their leisure. The chapters are for the most part short, and each contains very valuable information such as is not usually found in large text-books on medical subjects.

Morris's Human Anatomy. Edited by Henry Morris, M.A., M.B. (Lond.), F.R.C.S. (Eng.), President of the Royal College of Surgeons of England; Consulting Surgeon to the Middlesex Hospital, etc., etc.; and J. Playfair McMurrich, A.M., Ph.D., Professor of Anatomy, University of Michigan, etc. Pp. 1530. London: J. & A. Churchill. 30s. net.

For some years past *Morris's Human Anatomy* has been one of the best-known and most used text-books on that subject both in England and in America, and we welcome therefore in this new edition—the fourth—the combined work of English and American anatomists. Many of the articles, which were originally written by the former, have been revised and largely re-written by the latter. The work is profusely Illustrated, and all the figures are exceptionally clear and easy to follow. Special attention has been given to the nomenclature adopted by the German Anatomical Society, and now generally known as the Basle nomenclature or B.N.A. The book is published in one volume, and also in five parts, each of which may be obtained separately. This is a great advantage to those senior students who may wish to obtain the portion which deals solely with Surgical and Topographical Anatomy.

A Short Manual for Monthly Nurses. By Charles J. Cullingworth, M.D., F.R.C.P., Consulting Obstetric Physician to St Thomas's Hospital. London: J. & A. Churchill. 1s. 6d. net.

This well-known manual, which has now reached its sixth edition, bids fair to maintain its well-deserved popularity for many years to come. The advice it contains is sound and practical, and is given in that simple manner which is so suitable for the monthly nurse. We cannot, however, understand Dr. Cullingworth's faith in 1 in 4,000 corrosive sublimate solution as a preventive of purulent ophthalmia in new-born children, as nothing less than a strength of 1 in 1,000 is germicidal to the gonococcus. Not the least important part of the book is the appendix, "Of Some Useful Recipes." Not only is the monthly nurse advised to carefully study this little volume; but also the student and junior practitioner, who could do so with much profit, and they, in their turn, could not fail to be charmed with the grace of Dr. Cullingworth's literary style.

The Pocket Anatomy. By C. H Fagge, M.S. (Lond.), F.R.C.S. Sixth edition, revised. London: Baillière, Tindall & Cox. 3s. 6d. net.

This is a new edition of the well-known *Pocket Gray* under a new name, the old one being deemed inaccurate, as the compiler has no longer restricted himself to abstracting *Gray's Anatomy*, but has also borrowed from other standard works on the subject. Although the whole book has been carefully

revised, and many descriptions have been changed, notably the substitution of Jonnesco's account of the iliac and pelvic colon for that previously given of the sigmoid and rectum, nevertheless, the book essentially retains its former character as a concise and accurate *multum in parvo* of anatomy, to which its great popularity has hitherto been due. This will undoubtedly be maintained by the present edition.

What to do in Cases of Poisoning. By William Murrell, M.D., F.R.C.P., Physician to the Westminster Hospital; Lecturer on Clinical Medicine and Joint Lecturer on the Principles and Practice of Medicine, etc., etc. Pp. 280. London: H. K. Lewis. 3s. 6d.

Dr. William Murrell's little book is so well known that it needs no words of recommendation. The edition before us is the tenth, and contains a mass of valuable information, which has been compressed into a very small space, so that the book can be conveniently carried in the practitioner's pocket or placed in his bag along with the instruments and dressings. In the introduction, Dr. Murrell says: "If sent for to a case of poisoning, go at once—the patient's life may depend on your prompt attendance. . . . . Take your antidote bag or case with you." We would add—Let that antidote bag also contain a copy of this useful and practical little book.

Medical Laboratory Methods and Tests. By Herbert French, M.A., M.D. (Oxon.), F.R.C.P. (Lond.), Assistant Physician to Guy's Hospital, etc. Pp. 168. Illustrated. London: Baillière, Tindall & Cox. 5s. net.

Of the smaller books, which deal with laboratory methods and chemical tests for the fluids and substances obtained from patients, we believe this to be one of the best. Dr. French has been at no small amount of trouble to bring this new edition up to date, and he is now to be congratulated upon the excellence of the present volume. It contains twenty-nine coloured and fifty-nine plain illustrations, all well executed, and we have no doubt that the book will serve to satisfy a long-felt need amongst senior medical students and general practitioners.

Manual of Operative Surgery. By John Fairbairn Binnie, A.M., C.M., Professor of Surgery, Kansas State University. Third Edition, revised and enlarged, with 678 illustrations. London: H. K. Lewis. 12s. 6d. net.

When two fairly large editions of a book on operative surgery have been exhausted, there is no need for such an excuse as is given in place of the preface in Professor Binnie's Manual for the issue of a third edition. The scope and aim of Dr. Binnie's work is stated by himself to be "a little book on operative surgery, in which there should be omitted, so far as possible, all description of those procedures which are ordinarily thoroughly given in the usual text-books on general surgery." During the course of its brief existence, the book has considerably grown; thus, in the second edition, articles on the duodenum and on tuberculous peritonitis were added, whilst, in the present edition, a few classical operations on the genito-urinary organs and on the anus have been added. The remainder of the work has also been carefully revised, and one hundred and eleven new illustrations have been added. All these improvements add to the value of this highly successful manual.

Notes by the Way.

Short-lived Doctors.

A MEDICAL contemporary recently drew attention to the fact that doctors are a short-lived class of the community. Laymen were naturally surprised. Their view presumably is that the days of doctors should be longer in the land than those of other people because they know better than their patients what to "take" when they feel indisposed or are in the way of infection. Longevity, however, depends far more upon the manner of a man's life than upon the drugs which he swallows; and it is the doctor's misfortune that the exigencies of his calling often make it impossible for him to practise the hygienic doctrines which he preaches. *Obsta principiis* is one sound maxim on which it is specially hard for him to act. He cannot afford to lay up and nurse himself for trivial ailments, but must often be out attending to his patients in spite of a general feeling of malaise. His night's rest may often be broken though he knows that seven hours sleep is the ideal. He may have to take his meals irregularly, though he is well aware of the virtue of regular habits, or to rush out to an urgent case in the middle of his dinner, though he is always warning his patients that that way lies indigestion. Moreover—if he is a general practitioner—those long holidays which he is fond of proclaiming to be essential are very seldom for him. All these disadvantages count for more in the long run than his acquaintance with the quickest means of relieving a headache or soothing a catarrh; and the sum of the whole matter seems to be that the doctor, who made his own health his chief concern, would have to retire from practice in order to attend to it.

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Back to the Land.

IN an interesting letter to the *Times*, Mr. Jesse Collings urges the importance of adopting measures whereby the sort of men who are now emigrating, under the auspices of the Salvation Army, to Canada should "be gradually planted on our own

deserted country side" where there are, he assures us, "vast areas of uncultivated land." Whether the measures which Mr. Collings contemplates include the taxation of imported corn, meat, cheese, and butter, his letter does not explain. If so he raises questions the discussion of which scarcely falls within our province. In any case, however, the cry of "back to the land" commands the active sympathy of all who are interested in the physical well-being of the population, though it by no means follows that it is necessary to their well-being that they should occupy the land in an agricultural capacity. Labour-saving inventions have lately reduced, and will no doubt continue to reduce, the number of men required for the carrying out of any given agricultural operation. A very small proportion of men per square mile have to be employed for grazing or even for corn-growing. A larger proportion are required for fruit farms and market gardens, but hardly enough, we fear, to effectively counterbalance the constant flow of labour towards the industrial centres. The movement which really seems to promise perceptible results is that of the reformers who are trying to transfer the industries themselves —or such of them as are transferable—from the cities to the country. The establishment of the book-binding industry at Letchworth is one instance, and there are a good many others, all seeming to point to the fact that the best road back to the land—the road, that is to say, which the largest number will be induced to tread—lies through the Garden City, the inhabitants of which may be quite as vigorous and healthy as the ploughmen, even though they spend the working hours of the day indoors.

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Children and Tuberculosis.

It is sincerely to be hoped that the National Children's Home and Orphanage will be successful in its appeal for funds for the establishment of a Sanatorium for those of the children in its charge who are suffering from or threatened with tuberculosis. The two great modern discoveries with regard to consumption—that it is infectious, and that it is, in favourable conditions, curable—afford a double reason for generous support of the philanthropic enterprise. The segregation of the sufferers will necessarily help to stay the spread of the disease; and

the majority of the cases, there is every reason to hope, will be taken in hand at a stage at which it will be possible to conquer the disorder. The Sanatorium, in short, will be rather a Home for the Delicate than anything of the nature of a Hospitable for Incurables. By no means the least gratifying detail in the plans of the promoters of the undertaking is to be found in the announcement that they will not regard their responsibilities as ceasing when the children are discharged from their home, but will try to find them such openings in life as are suitable to their strength and constitutions, and will continue to keep them under observation. This is very important. Many of them, one fears, though apparently cured, will remain delicate, and will have to plunge into the battle of life under that disadvantage. Left to themselves, they might easily drift into some occupation in which undue strain would be imposed upon their inherited tendencies to tubercular disease. Wisely helped and guided—enabled to avoid the depressing conditions of overcrowded and insanitary slums—they may escape relapse, and live long and healthily and usefully. About £5,000 had been collected for the Sanatorium when the Lord Mayor presided over the meeting held in support of it at the Mansion House, and there ought to be little difficulty in raising the further sum of £5,000 that is still required before the work can be commenced.

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Eugenics Education Society.

THERE are those who hold that the Eugenics Education Society sometimes protests too much, and is too prone to propose restrictions on the liberty of the subject which cannot be advantageously enforced in an imperfect world. It has, however, unquestionably rendered a useful service by its vigorous pronouncement on the dispute between the Government and the London County Council, which has led to the refusal of the latter body to administer the Inebriates Act. In so far as the quarrel concerns the allocation of financial liability, there are, no doubt, two sides to the question at issue. What is clear to the plain man, and specially clear to the student of Eugenics, is that the quarrel ought to be quickly composed in order that the larger interests of the community may not suffer. The real value of the Inebriates Act is not that

it simplifies the task of the police and the magistrates in dealing with incorrigibles of the "Jane Cakebread" order, or that it cures degenerates of their alcoholic craving. The police are quite capable of dealing with the problem in the shape in which it presents itself to them by their own rough rule-of-thumb, and the cases compulsorily detained in public Inebriate Homes are more often than not incurable. The case of the irreclaimable Janes Cakebread, in short, has to be recognised as more typical than that of "Spring Onions," her reformed brother in excess. The application of the Act did at least, however, keep such women as Jane Cakebread off the streets. To suspend the Act is to send them back to the streets, and to the opportunity of becoming mothers. The suggestion has been made that their habits of indulgence render them incapable of maternity; but that view is not borne out by the facts. Statistics show that 365 women convicted as criminal inebriates and consigned to reformatories in 1905–1906 were the mothers of 2,200 children—2,200 children of whom it may almost be said that they are predestined, if they grow up, to become criminal inebriates in their turn. The detention of such mothers, actual or potential, would assuredly do more to make England sober than the closing of any number of public-houses, for it would tap the supply of drunkards at its source. The astounding thing is that neither the Home Secretary nor the London County Council seem to have given a moment's thought to this aspect of the question. Both of them appear to look at the matter solely from the points of view of public expenditure and public order. The strongly-worded resolution passed by the Society at its annual meeting is now, however, before them; and we trust that it will stimulate them to more profitable reflection.

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X-Rays and their Dangers.

THE grave, but only partially explored, dangers attending experimentation with X rays have been further exemplified by cases occurring both in England and America during the past month. Medical and scientific knowledge have often to be purchased at the price of such perils, faced sometimes knowingly and sometimes inadvertently. Sir James Simpson's numerous experiments

with chloroform furnish one case in point; and there are plenty of instances of experimental inoculations. The case against the mosquito, for instance, as the chief, if not the sole, agent in the dissemination of malaria was made complete by voluntary submission to the experimental bites, first of the culex and then of the anopheles variety. In the case of the rays, of course, the danger was not known to exist until the symptoms of the first case of X-ray dermatitis were manifested; and even then it was supposed that the danger could be nullified by the adoption of precautions since shown to be indequate. The complaint is very insidious and very painful; and all honour is due to those who persevere with their work with X-rays in spite of the certain risk and the uncertain efficacy of the safeguards. Possibly some experiments have been conducted with unnecessary rashness. That is always apt to be the case when students are eager or in a hurry. More care is taken now. Doctors engaged in the work of radiography should now protect themselves efficiently by using material opaque to the rays, and also employ specially constructed screens. It may be too soon to say that the protection thus secured is absolutely infallible; but there is good reason to hope that it may prove to be so, and that the use of a discovery so valuable alike in medicine and surgery may, in the future, be safe to the radiographer, as well as beneficial to the patient.

Practical Notes.

Cervical Erosions.—That portion of the uterine cervix which projects through the upper end of the anterior wall of the vagina into the vaginal vault is known as the portio vaginalis. Its vaginal aspect is covered by a mucous membrane, consisting of stratified epithelium, continuous with that of the vaginal walls, which fits the portio vaginalis like a tailor's thimble. The canal of the cervix is also lined by a mucous membrane, which is sometimes termed the cervical endometrium, and which consists of columnar epithelium continuous above through the os internum with that of the body of the uterus. The cervical endometrium and the mucosa of the portio vaginalis normally meet at the os externum. Under these conditions, the outer aspect of the cervix, as revealed by inspection through a vaginal speculum, is uniformly smooth and pale pink right up to the orifice of the cervical canal. It is also firm to the touch and does not bleed on handling.

In cases where so-called "erosions" of the cervix exist the mucous membrane, immediately surrrounding the os externum and for a variable distance from it, is changed, and the altered condition can be seen through a speculum, and can be felt on vaginal palpation. Surrounding the os externum is a soft velvety bright red tissue which readily bleeds when handled.

Patients with this condition often present themselves at gynæcological clinics with the diagnosis—usually attributed to their medical attendants—of "ulcerated womb." Strictly speaking, the condition is neither an "ulceration" nor an "erosion," for there is no loss of tissue, as would be implied by these names, but there is a change in the nature of the tissues as indicated by the following definition of Findley's:—"An erosion of the vaginal portion is a mucous patch consisting of a layer of columnar epithelium and newly-formed glands lying beyond the external os, and replacing squamous stratified epithelium."

Types of Erosions of the Cervix Uteri.—Erosions of the cervix are classified into (1) simple, (2) papillary, and (3) follicular.

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A *simple erosion* has a flat smooth surface and a velvety feel. It is covered with a single layer of columnar epithelium, and new formed glands may dip into the subjacent connective tissue.

A *papillary erosion* presents a papillary surface owing to deep invagination in the form of glands lined by a single layer of columnar epithelium, alternating with elevations of newly-formed connective tissue infiltrated with leucocytes.

A *follicular erosion* is one in which the newly-formed glands become occluded, retention cysts—the so-called ovula Nabothii—being thus formed.

Little is definitely known regarding the ætiology of this condition. It is sometimes met with in virgins and young girls, and is then presumed to be of congenital origin—the so-called *congenital erosion* of the cervix.

The disease is, however, more common in women who have borne children than in nulliparæ, and the most extensive lesions are met with in association with cervical lacerations following child birth.

It also occurs in cases of endometritis and of chronic cervical metritis, which, again, are often found along with retro-displacement of the uterus. In cases of chronic cervical metritis, when the formation of Nabothian follicles is associated with marked hypertrophy of the cervical tissues, the condition is known as Virchow's *follicular hypertrophy of the cervix.*

Erosion of the cervix gives rise to marked symptoms, the most prominent of which is an increased vaginal discharge. The normal secretion from the mucous membrane of the uterus and cervix is a clear viscid fluid like white of egg, and is not sufficient to attract attention. When excessive, as in marked cervical erosions, it is termed leucorrhœa, or popularly "the whites." Pain in the back in the form of constant backache is also present, as in all forms of uterine disease, and it is aggravated by exertion, such as walking, riding, cycling, etc. It is sometimes referred to the left submammary region, and occasionally to the perineum. Pruritus is also occasionally present. Menstruation may also be irregular and excessive, but this is rather due to the accompanying endometritis. General weakness supervenes in long standing cases and leads to many subjective symptoms, such as nausea,

headache, giddiness, insomnia, and similar disturbances, which are often ascribed to hysteria and to neurosis. Sterility often ensues, since the presence of the catarrh and excessive discharge, though not an absolute bar to conception, greatly diminishes its probability.

The diagnosis of cervical erosion is readily made. The history is suggestive, and on vaginal palpation the soft velvety feel round the margins of the os externum is characteristic. The introduction of a speculum also reveals the reddened area round the os externum. It should be remembered, however, that a very similar appearance is seen in cases of ectropion, or eversion of the mucous membrane of the cervix associated with laceration.

Treatment of Cervical Erosions.—In the treatment of cervical erosions, general must be combined with local treatment, for if the latter alone is relied upon, we shall often be disappointed. The general health may be improved by the administration of tonics, such as iron, arsenic, quinine and strychnine, by change of air and light nourishing diet, by regulated exercise, and by attention to disturbances of the digestive tract. Sexual activity is to be prohibited, and this can most readily be secured by sending the patient away from home for a time. Local treatment consists in applying caustic substances to the diseased surface, and this can readily be done as follows :—Place the patient on her back on the end of the couch, with the legs flexed and everted. Then pass a Fergusson's speculum of appropriate size, and expose the cervix by manipulating the speculum. By means of cotton-wool swabs on holders, mucus is removed, and the exposed parts are wiped dry. Pure liquefied carbolic acid or iodised phenol, which consists of iodine 1 part and liquefied carbolic acid 4 parts, is then applied very freely to the diseased surface by means of cotton-wool mops on holders ; at the same time the caustic should be applied for a short distance up the cervical canal by means of a uterine probe. Any conspicuous ovula Nabothii should also be punctured. Pure nitric acid may be used in the same way. After it has acted for a minute or two, excess of acid should be neutralised by a solution of sodium carbonate. A tampon, consisting of a plug of cotton-wool with silk ligature attached, is then introduced through the

speculum into the vault of the vagina, and the patient is instructed to remove this by pulling on the silk ligatures on the following morning, after which vaginal douches of boracic acid should be administered daily. For very slight cases, a single application may suffice to cure the condition, whereas several applications at intervals of two or three days may be necessary where the disease is more extensive. When associated with endometritis, curetting will also be required, when associated with bilateral laceration of the cervix, trachelorrhaphy should be performed, whilst if retro-displacement of the uterus is present, no cure can be brought about until position of the uterus is rectified by manipulation and retained by the use of pessaries or the performance of ventrofixation.

Abdominal Examination in Labour.—In the rational conduct of a case of labour, the practitioner proceeds to ascertain the presentation and position of the fœtus at the earliest possible moment, and these conditions are readily made out in a normal case at the first examination during labour. There are two ways in which this examination can be carried out, namely:—By abdominal and by vaginal examinations each of these methods supplementing the other, the abdominal examination being of chief importance in the earlier stages of labour, whilst the vaginal examination gives the more precise information in its later stages. The older generation of practitioners were only taught the method of vaginal examination, and in this they are well versed, but many of them are as yet not alive to the significance and importance of abdominal examination and the knowledge that can be obtained by its use. Further, in performing the abdominal examination, there is no risk of introducing pathogenic organisms into the genital tract, whereas, even when every precaution is observed, this risk cannot be entirely eliminated in the case of vaginal examinations. Hence for diagnostic purposes, vaginal examinations should be made as seldom as possible, especially as most of the required information can be obtained from abdominal examination. By the substitution of abdominal for vaginal examinations in labour, it is to be hoped that the morbidity and mortality from puerperal sepsis—which in

this country still remain much too high—will be substantially diminished.

To perform abdominal palpation the patient should lie on her back with the shoulders slightly raised. Then expose the abdomen and fold some clothes over the patient's chest; this prevents her watching the manipulations, and thus diverts her attention from the examination.

The hands should be warmed and used gently, or the abdominal wall will become rigid, and little information will be obtained. During the pains, of course, nothing could be learned from palpation. The bladder should also be empty.

In abdominal palpation four methodical "grips" are described, namely:—(1) the fundal; (2) the umbilical; (3) Pawlik's; and (4) the pelvic. The examining physician sits or stands by the patient's bed, facing her head for the first three "grips," and facing her feet for the fourth.

In the fundal grip the fundus is gently palpated with both hands between the pains. The breech or head is felt to occupy the fundus. The breech is recognised when it moves with the child's body, and by the absence of groove between them. The head is recognised as a hard globular mass, which is separated from the child's body by a distinct groove, and which can be moved without moving the body of the child.

The hands are then gently moved downwards past the umbilicus, when the smooth resisting back can be readily felt to one side in an anterior position, and the knobs of the small parts, *i.e.*, hands and feet, are indistinctly felt on the opposite side. In posterior positions the reverse is found, the resisting back being indistinct, and the small parts readily felt. In the Pawlik grip the presenting part is grasped by one hand placed just above the pubic symphysis. The thumb of one hand on one side, and the fingers on the other, are sunk down on either side of the presenting part—usually the head. By grasping the head in this way, it can be readily ascertained if the presenting part is fixed, that is, cannot be moved from side to side between the pains. This fixation of the presenting part is a sign that labour has commenced in a multipara, though in a primipara it occurs about three weeks before labour. Further, this grip also shows the condition of the head as

regards flexion, by the relative ease with which the prominent forehead or sloping occiput can be felt, that is to say, whether the presentation be vertex, brow, or face. Again, the amount of the head remaining above the pelvic brim indicates how far the head has sunk into the pelvic cavity. If the whole head has entered the pelvis, the fingers sink into the groove between the head and shoulders, and the presenting part is not felt by Pawlik's grip. The fourth, or pelvic, grip should then be made. Turn round and face the patient's feet and gently press the two hands, with the fingers extended, downwards on either side into the pelvic cavity. In this way the head can be felt until it has almost reached the perineum, and the advance of the child can be observed by noting how much more the head has sunk in the pelvic cavity between two examinations. By careful abdominal examination the practitioner, with a little practice, can readily make out the presentation and position of the child, and can also readily observe the progress of labour; relying on the facts so ascertained, vaginal examination becomes less necessary, and is consequently undertaken less frequently.

Preparations, Inventions, etc.

FERMENLACTYL TABLETS.

(The Pasteur Vaccine Co. Sole Agents—The Anglo-American Pharmaceutical Co., Ltd., 3 and 5, Frith Road, Croydon.)

These tablets, containing a pure lactic acid ferment, are prepared from the special bacillus of Bulgarian milk from cultures isolated in the Pasteur Vaccine Co.'s Laboratories in Paris. In Bulgaria, where milk, one of the chief articles of diet, is never taken *au naturel*, but always curdled as "Yoghourt," the ferment is known as "maya" and was found by Massol to consist of *B. acidi lactici*. Especially in the treatment of the various forms of fermentive dyspepsia will Fermenlactyl Tablets be found particularly effective.

ANTISCLEROSIN.

(Messrs. Reitmeyer & Co., 63, Crutched Friars, London, E.C.)

These tablets contain the normal salts of the blood except the potash compounds, and in addition glycero-phosphate of calcium. They are composed approximately of about 80 per cent. of sodium chloride, 8 per cent. of sodium sulphate, 3 per cent. of sodium carbonate and of magnesium phosphate, and $2\frac{1}{2}$ per cent. each of sodium phosphate and calcium glycero-phosphate. They represent a distinct advance in the treatment of arterio-sclerosis on the lines of Trunecek's serum, and are commended by Professor Senator. Treatment according to Senator should be begun by giving two tablets a day to be gradually increased to six a day, with occasional intermissions for a day or two. Decrease in the amount of salts in the blood is a feature in arterio-sclerosis, but it is not known yet whether it occupies the position of cause to effect.

NOVASPIRIN.

(Messrs. The Bayer Co., Ltd., 19, St. Dunstan's Hill, London, E.C.)

This is a new salicylic preparation which is chemically methylene-cytril-salicylic acid, and contains 62 per cent. of

salicylic acid. It is introduced as a safe and efficient substitute for salicylates. It is absorbed slowly and does not produce profuse perspiration. In the intestines, it decomposes into nascent salicylic acid and methylene-citric acid, and, as far as we are able to trace, gives rise to no irritation. The dose is 15 grains several times a day, and, as it is insoluble in water, it must be given in cachets or powders. In influenza Novaspirin has been found to be of great value, and its use is, of course, further indicated in all cases in which salicylates have been proved to be of service.

SAUERIN.

(Messrs. Allen & Hanburys, Ltd., 37, Lombard Street, London, E.C.)

Under this name are introduced tablets containing a vigorous strain of *Bacillus acidi lactici.* They may be used for making "curds," the excellent effects of which, as an intestinal antiseptic, are so warmly commended by Metchnikoff, who himself partakes daily of a bowlful; or they may be taken internally. These Sauerin tablets produce curds which differ altogether from the ordinary rennet-production in the large quantity of lactic acid bacilli present of known origin. These establish themselves in the intestine and inhibit the growth of the *B. coli communis,* and other saprophytes. Intestinal stasis and putrefaction are coming more and more into prominence as factors in the production of the toxines, which are the true cause of many diseases local, like colitis, and appendicitis, as well as general, like gout, rheumatism, and, as Metchnikoff believes, arterio-sclerosis and other senile degenerations. A solid mass of curd results when milk, previously sterilised to exclude all other ferments, is treated with pure cultures of the *B. acidi lactici.* A small amount of sugar helps the process, and the product is quite palatable. Cases of cancer of the stomach retain and assimilate "Yoghourt" in the stomach when all other means of feeding are refused.

THE PRACTITIONER.

MAY, 1908.

ON SOME POINTS IN CONNECTION WITH VACCINE-THERAPY AND THERAPEUTIC IMMUNISATION GENERALLY.

By SIR ALMROTH E. WRIGHT, M.D., D.Sc., F.R.S.,
Director of the Department for Therapeutic Inoculation, St. Mary's Hospital.

ALREADY in my first paper on the treatment of staphylococcus infections by the therapeutic inoculation of staphylococcus vaccines, I suggested that we had in vaccine therapy a general therapeutic method which would be applicable to the treatment of all kinds of localised bacterial infections. In my next publication on therapeutic inoculation, I made bold to predict that the physician of the future would be an immunisator. Already these anticipations are justifying themselves. I do not know that there is anyone who has made trial of vaccine-therapy in connection with localised bacterial diseases who is not satisfied with its efficacy as a therapeutic measure, and the day when the physician will be an immunisator is, I think, perceptibly nearer.

Far from the possibilities of vaccine-therapy in the field of the treatment of localised bacterial infections being already exhausted, those possibilities have as yet been only very incompletely explored. Only few and tentative experiments have, up to the present, been undertaken in connection with bacterial infections of the mucous membranes. The application of vaccine-therapy in connection with endometritis and bronchitis is almost unstudied, and the method has not yet been applied to whooping cough or to mumps. The question as to whether the Klebs-Loeffler bacilli, in the case where these survive on the throat after an attack of diphtheria, can be eradicated by vaccine-therapy, and the precisely similar question which presents itself in connection with the persistence of typhoid bacilli and other pathogenetic bacteria after convalescence, are in like manner still untouched. Again, while it

may be taken as certain that in malignant disease advantage may be obtained from vaccine-therapy directed to the destruction of the microbes which invade the tumour, final judgment on the question whether this has any retarding effect upon the disease cannot yet be pronounced. Lastly, it cannot be doubted that there are numberless disorders which, though they are not now brought into connection with bacterial infection, are in reality directly caused by such. Many of these might prove amenable to vaccine-therapy. Jaundice and cholecystitis would almost certainly come under this category. Again, if I may draw any deduction from an almost desperate case, which I have recently seen get well under vaccine-therapy, there would be a prospect of success in certain cases of pancreatitis. And I cannot refrain from going one step further, and throwing it out as a suggestion that there may quite well lie at the root of pancreatic diabetes a bacterial infection (possibly sometimes a colic or a tubercle infection) which might perhaps be amenable to vaccine-therapy.

Leaving all these problems for the future to resolve, I may, before I pass to the subject-matter proper of this paper, put you in mind of certain recent developments in connection with vaccine-therapy and auto-immunisation.

(*a*) It has been established by my fellow-workers and myself in the Inoculation Department of St. Mary's Hospital, that vaccine-therapy is applicable not only to localised infections but also to septicæmic diseases.

(*b*) We have shown that spontaneous auto-inoculations occur not only in connection with septicæmic diseases, but also in connection with localised diseases where the focus of infection has attained to a certain development.

(*c*) We have shown that auto-inoculation can, in the case of localised disease, be artificially induced by massage, by active and passive movements, and by active and passive hyperæmia affecting the focus of infection.

(*d*) We have shown that such artificially-induced auto-inoculations can be turned to useful account in diagnosis, evidence of an auto-inoculation with the products of a particular microbe being equivalent to proof of the presence of that microbe in the particular region of the body which has been explored.

(*e*) We have shown that the success of certain empirical methods of treatment, and, in particular, the success of Bier's method of passive congestion, is probably largely dependent upon the fact that, when skilfully and felicitously applied, it induces adequate and not excessive auto-inoculations.

I do not propose here to go back over any of this ground. It has been traversed by my fellow workers and myself in a conjoint paper contributed to the *Lancet* of November 2nd last.

Let me, instead, deal with two other issues which present themselves for consideration in connection with therapeutic immunisation.

The first of these has reference to the question as to whether it would not be possible to achieve and maintain the desired improvement in the patient's blood apart from periodic blood-examinations. Associated with this is the question as to whether the technique, which we use for the determination of the opsonic index, gives accurate and useful results.

The second issue has to deal with the question as to what is the best method of directing such protective agencies, as a patient may be possessed of, or acquire by immunisation, to the destruction of the microbes in the focus of infection.

PART I.

Question as to whether it would not be possible to achieve and maintain an increased output of protective substances apart from periodic measurements of the content of the blood in protective substances.

The importance of this issue will appear when we reflect upon what is bound up with it. There is bound up with it the question whether it is imperative upon every physician, before embarking upon therapeutic immunisation, to serve an apprenticeship in bacteriology, to master the technique of blood testing, and hereafter to undertake, in connection with his cases, the labour of making periodic blood examinations.

In discussing this question, I think we may, at this hour of the day, confidently assume that no one would now seriously advocate that injections of bacterial vaccines should be undertaken entirely in the dark, as was done in connection with the earlier inoculations of Koch's tuberculin. Everyone will agree that since we have, in vaccines, an agency that is, according

as it is wisely or unwisely used, powerful for good or for ill, we must, where we employ vaccines, either have a guarantee for the correctness of the dosage, or a system of control which will tell us when our dose is too large, when it is too small, and when it ought to be repeated. I may, therefore, take it that the suggestion that the inoculation of bacterial vaccines should be undertaken apart from anything in the nature of controlling blood examinations, is to be understood not as a contention that the dosage need not be a matter of concern, but rather as a suggestion that the accumulated experience of the past, and the observation of the clinical symptoms, will serve as adequate guides in any immunisation procedures.

This suggestion—though it may perhaps have suffered something from the advocacy of those who are above everything concerned to avoid anything in the nature of undue personal effort, and anything in the nature of a change in the established order in our profession—is none the less deserving of our most earnest consideration, for there can be no question but that the shortest and least laborious way to a result is, where it can be safely followed, always the best way.

It will facilitate the discussion of the question as to how far periodical blood examinations may be dispensed with in favour of other methods of regulating the dosage, to introduce a little more precision into the suggestion that past experience and observation of the clinical symptoms may serve us as a sufficient guide into our immunisation procedures. We may read this (*a*) as a suggestion that we have already, by clinical observation and blood testings, attained to such knowledge of the effects of bacterial vaccines as enables us to guarantee that a good result will follow upon the inoculation of a particular dose of a standardised vaccine. Or, again, we read it (*b*) as a suggestion that, even if such absolute guarantee as might be desirable should not yet be available, the clinical symptoms of the patient will inevitably furnish such further data as might be required for the regulation of his dosage.

Suggestion that, by clinical observations, and blood-testings, such a knowledge of the effects of bacterial vaccines has been arrived at as would make it possible to guarantee a good result from the inoculation of a definite quantum of a standardised vaccine.

Though inexperience might suppose that the blood testings, which have been carried out, and the clinical experience which has been gained, would enable us to foretell with absolute accuracy the effect of a given dose of this or that vaccine upon the human organism, we have not only not arrived at this point, but there is very little likelihood of our ever arriving at it. Where we are handling, on the one hand, vaccines, and on the other hand, the human organism, we are dealing with factors neither constant nor invariable.

Let us consider, first, the vaccine. Here, even where we particularise a particular dose of a vaccine which has been standardised by counting the contained microbes or by weighing the contained microbial substance, we can never leave out of consideration the possibility that a difference in the strain of microbes employed, or some minute overlooked difference in the mode of preparation, or perhaps some change occurring spontaneously during keeping, might affect the potency of the vaccine. It will follow that where we prescribe, let us say, a dose of gonococcus or streptococcus vaccine, such as would correspond to 1,000,000 gonococci, or, as the case may be, 1,000,000 streptococci, we cannot always be sure that we shall be applying precisely the same *ictus immunisatorius*. Here, then, is one of the difficulties, which stand in the way of our accurately forecasting the effect of the inoculation of a bacterial vaccine. It is a difficulty which can be circumvented only by directly controlling the effect of the vaccine upon the patient. More formidable is the difficulty which is created by the fact that there is not, as is clearly shown in connection with preventive inoculation against typhoid fever, any constancy in the immunising response of healthy men to one and the same dose of one and the same vaccine.

And greater than all is the difficulty which is created by the fact that there are very great differences in the effect produced by one and the same dose of vaccine in the infected as compared with the healthy, and in the severely infected as compared with the lightly infected. For this reason it is impossible to accurately foresee the effect which a vaccine will produce when inoculated into an untried patient.

Lastly, still further difficulties arise where we are asked to predict, instead of the result of an isolated inoculation, the

effect of a whole series of inoculations periodically undertaken upon a patient. The difficulty of prediction here is insuperable, owing to the circumstance that, either as the result of the patient's personal factor, or as the result of the special features of his infection, the point at which he fails to respond to small immunising stimuli, and the point at which he tolerates and responds to larger immunising stimuli, are reached in the one case earlier and in the other case later.

While the fact that our powers of prevision are thus limited must be emphasised and kept in view, there would be grave error in supposing that we can never predict the results of an inoculation. If there is, in connection with bacterial vaccines, one thing which is more assured than another, it is that it must always be possible, after it may be a lengthy process of trial and error, to arrive at a dose regarding which it will thenceforward be possible to predict that it will, when employed upon patients who are suffering from a localised infection of strictly limited extent, produce either a very slight negative phase followed by a positive phase, or a positive phase without the intervention of any negative phase. Such doses, when they have once been arrived at, may be safely employed apart from an exercise of control on the part of the practitioner in the treatment of strictly localised infections.

It may be predicted, in connection with a staphylococcus vaccine, that it will, when administered in a dose corresponding to 100 million of staphylococci to a patient, who is developing an isolated furuncle, practically always produce an immediate positive phase and arrest the development of that furuncle. It may further be predicted of a dose corresponding to 250 to 300 millions of staphylococci, administered three to four days later, that it will reinforce the action of the previous dose, and practically always put an end to the furuncle. Again it is probably safe to predict of a streptococcus vaccine, which has been prepared from an ordinary case of erysipelas, that it will, when inoculated in a dose corresponding to 2,000,000 of streptococci, abort, or at any rate temporarily arrest, an incipient streptococcic lymphangitis. In like manner, where we have to deal with a tubercular adenitis or arthritis of strictly limited extent, it may be predicted that an initial dose of 1–20,000 mgr. of a dried and comminuted tubercle

culture will give a satisfactory positive phase without the intervention of any serious negative phase. If, however, inquiry were made for a dose of the same vaccine, which would apply to all tubercular patients without distinction, that demand, being coupled with the condition that a serious negative phase should, in no case, be produced, the dose would probably have to be fixed at not larger than 1–50,000 mgr.

The question of the appropriate dosage to employ, when taking in hand a case of tubercular infection carries us on—since here there can be no question of eradicating the infection by one or two inoculations—to consider the question whether it would be possible to lay down a scheme of dosage such as would comply, on the one hand, with the proviso that a positive phase should follow upon every inoculation, and, on the other hand, with the proviso that no serious negative phase should in any case result.

Assuming a case of strictly localised tubercular infection of limited extent, and postulating inoculations at 10-day intervals, it might perhaps be tentatively laid down that, starting with a dose of 1–20,000th mgr. of Koch's tubercle powder, this dose might, as a rule, be increased every month by gradual increments up to 1–4,000th mgr., this latter dose being reached only after the expiration of six months' treatment. There would indubitably be many cases which would benefit under the exhibition of more generous doses. And, again, there would be other cases where, after years of treatment, doses of 1–20,000 mgr. could not with advantage be exceeded.

I think it will have become clear, from the consideration of these data, that, if in connection with tubercular infection, a hard-and-fast scheme of dosage were to be laid down, such as might safely be carried out in the absence of any method for readjusting the doses, it would—and what applies in connection with tubercular infections applies *mutatis mutandis* to all other chronic infections—it would, I say, be necessary to employ almost minimal doses of vaccine. In point of fact, doses would have to be employed which would not allow of the attainment of either satisfactory or rapid results in the majority of patients. Some method of controlling and readjusting the dose to the special requirements of each individual case is thus seen to be essential.

Let me now turn to consider the suggestion that the clinical symptoms of the patient are capable of furnishing the guide of which the immunisator stands in need.

Suggestion that the clinical symptoms of the patient will furnish to the immunisator a guide by which he may regulate his immunisation-procedures.

It is one thing to assert that it is very often possible for the immunisator to glean from the patient's symptoms information which would assist him in selecting his doses of vaccine, that such help can be obtained is a self-evident truth, it is quite another matter to put forward—as has recently been done—the suggestion which stands at the head of this subsection. We have it here implied that the clinical symptoms of the patient will in every case inform us whether we have been employing the proper quantum of vaccine, or too large, or too small a quantum. It is the suggestion thus understood which I propose here to critically consider.

If I were directly addressing the authors of that suggestion, I do not say that I might not be tempted to deal with it by the Socratic method. I might in such case press for answers to the following questions, with a view of convicting its authors of having put forward an ill-considered proposal :—

(1) Is it quite certain that there will, in every case where immunisation may be called for, be clinical symptoms to guide us in our dosage ?

(2) Given the case where the patient presents an obvious pathological condition (I have in view here either a definite constitutional disturbance or a definite local lesion), what will be the symptoms which will tell us that we have inoculated, as the case may be, an appropriate dose, or an excessive dose, or too small a dose of our vaccine ; and, again, what will be the signs by which we shall know that the hour has arrived for re-inoculation ?

(3) Is there any certitude that such changes, as our inoculations may be capable of producing, will, in every case, be produced with sufficient promptitude to inform us, before the inoculation next in series falls due, whether we ought to employ the same dose of vaccine, or increase or diminish the dose ?

(4) Is it inconceivable, in the case where the localised focus of infection is shut off from the blood stream, that we may obtain by inoculation an effect upon the circulating blood without obtaining a corresponding change in the condition of the focus of infection ?

Instead of merely suggesting these questions, I will try to supply the answers. Let me begin by putting it to you that we have, in connection with the question as to whether we may trust to the clinical symptoms to serve as guides to us in therapeutic inoculation, to consider four different classes of cases. We have :—

(1) the case of a localised infection, which is of such a nature that the clinical observer can immediately either see for himself or learn of every change which occurs in its condition ;

(2) the case of a localised infection where the conditions are unfavourable to the observation of changes in its condition ;

(3) the case of an acute febrile condition ;

(4) the case where all local and general symptoms are in abeyance.

Let me deal with each of these cases seriatim, and before we have done, it will be found that an answer has been furnished to each of the questions which were formulated above.

(1) *The case of a localised infection, which is of such a nature that the clinical observer can immediately either see for himself or learn of every change which occurs in the focus of infection.*

The most typical examples of such infections as these are the staphylococcic infections of the skin and subcutaneous tissues, to wit, furunculosis, suppurating acne, and sycosis. These are representative, not only in the respect that they are directly accessible to inspection and palpation, but also in the respect that they may rapidly become better or worse. This acute evolution is, as consideration will show, very material, inasmuch as we can in such cases count on being put into possession of the results of the foregoing inoculation before we are called upon to undertake the inoculation next in series. In the same class with these may be placed the streptococcal infections of the skin and subcutaneous tissue which take the form of impetigo, serous furuncles,

erysipelas, and lymphangitis.

In the category of localised infections whose evolution can be readily followed, may further be placed infections of wound surfaces and mucous membranes by pyogenic micro-organisms. Here information can be drawn, not only from the appearances of the suppurating surfaces, but also from the amount of discharge. In the case where the seat of the infection, though communicating with the exterior, is more deep-seated—as, for instance, in the ear or uterus or male urethra—we can still draw certain inferences from the amount of the discharge and from its character.

In the category of local infections, whose course can be readily followed, may be included also many of the localised infections with which we have to deal in connection with the kidney, the bladder, the colon, and other organs. Here we may glean information with regard to the condition of the focus of infection by noting the character of the excretions, or, as the case may be, the amount of the secretion. We can, for instance, measure the quantity of albumen and the amount of pus in the urine. We can, again, in the case where we are immunising against a coli infection of the urinary tract, watch for that characteristically rapid clarification of the urine by flocculation and sedimentation which comes under observation when the microbes undergo agglutination in the urine. In colitis we can watch for a change in the excretion of mucus and in the shedding of the membraneous casts. In Miculicz disease—a disease which appears to be generally associated with a streptococcus infection of the salivary and lachrymal glands—we can take note of the variation in the amount of saliva and tears. And in those cases of cholecystitis, where, after operation, the bile evacuates itself through the operation wound, we can similarly obtain some information with respect to the infection by noting the changes in the bile.

Where the localised focus of infection is so situated as to interfere with a delicate reflex mechanism—I have in view here the case where frequency of micturition results from a bacterial infection—we have, again, a sensitive recording mechanism which may keep us informed with respect to the progress or regress of the infection.

And these objective signs, in connection with the focus of

infection, are not our only means of learning of the condition of the local focus. Where we have, in association with a local focus of infection, pain or discomfort, and, of course, we have these in connection with very many forms of localised infection, we can very often, through the intermediary of these, learn of any changes which may occur in the focus of infection. It will thus be seen that, by one way or another, we may, in connection with a large number of localised infections, hope to be kept informed with respect to their progress by the intermediary of the clinical symptoms.

The problem as to how we are to interpret this information and to turn it to account in regulating our dosage is very far indeed from being a simple problem. We have, however, in our hands an important clue to the interpretation of the clinical data when we call to mind that—

(*a*) A moderate dose of vaccine, such as would generally be the most useful dose in connection with a chronic infection, produces, after a comparatively short negative phase, a positive phase which might, on an average, extend over the interval between two successive inoculations undertaken some 10 days apart.

(*b*) A smaller dose would produce an immediate positive phase, but a positive phase which would not be maintained for more than a very few days.

(*c*) An excessive dose would produce a negative phase, which would last through a large part, if not through the whole, of the interval which usually elapses between two inoculations.

Keeping the graphic curves, which correspond to these three types of response, clearly before the mind's eye, we can now take the clinical history and see which of these different types of curve it will fit in with.

The chronology of the different incidents will here give most important indications. Where, in connection with pustular acne or furunculosis, there has been a fresh outcrop of spots, or a new furuncle, or increased pustulation, or where, in connection with tubercular cystitis, there has been more pain and increased frequency of micturition, or where, in connection with an infected wound or mucous membrane, there has been more discharge, or where, in connection with a gono-

coccal or tubercular arthritis or in connection with a tubercular adenitis, previously painless, pain has developed after inoculation, we may take it that there has been a negative phase, and that the type of response is that which is obtained by the inoculation of a moderate or, as the case may be, an excessive dose. Where the negative phase symptoms have been severe or prolonged it will be plain that the dose of vaccine has been excessive.

Where, on the contrary, we learn that there was improvement for a few days after inoculation, and afterwards a relapse to the conditions which obtained before inoculation, we may suspect that our dose of vaccine has been too small.

These conclusions will be confirmed if there has been associated with the exacerbation of the local symptoms, a rise of temperature, or a general feeling of malaise and constitutional disturbance, and, with the improvement in the local symptoms, a condition of euphoria.

Fallacies in connection with the interpretation of the clinical symptoms.

It might be supposed that, with the above clue in our hands, the interpretation of the clinical symptoms would, at any rate, in the class of cases we are here discussing, give us quite adequate guidance in the matter of dosage and the interspacing of our doses. This is very far indeed from being the case.

On the one hand, the conditions in the focus of infection may upon occasion be quite fallacious guides. And, on the other hand, the constitutional symptoms cannot be relied upon to convey all the facts which are material for us to know.

These points with regard to the fallaciousness and incompleteness of the clinical record, even at its best, may be conveniently considered here. We then need not come back upon them when we come to deal with the three other categories of clinical cases which were enumerated above.

(a) *The clinical symptoms which are associated with the focus of infection may convey quite an erroneous idea of the conditions which there obtain.*

Where, as is so often the case, a lupus which is infected by streptococci is being treated with inoculations of tubercle vaccine only, the local appearances may be very fallacious. In such a case progress in the direction of the suppression of the

tubercular infection may quite well be masked by the persistence or, as the case may be, incidental exacerbation of the streptococcic infection.

Where, in a case of combined infection by two species of microbes, both the microbes are attacked by vaccine therapy, with the result that one is successfully combated while no headway is made against the other, the appearances may quite well suggest to the purely clinical observer quite an erroneous idea of the state of the case. Where we are dealing with deep-seated infection we may erroneously attribute significance to an increase or to a recurrence of œdema.

In illustration of the opportunity for error, which presents itself in connection with œdema, I may instance the case of a patient who had been discharged as cured of a lupus of the nose, and who, alarmed at a recurrence of the swelling and reddening, recently came back again for further inoculation treatment. On examination of this patient's opsonic index a normal reading was obtained. It was also noticed that the patient's fingers were badly chilblained. This fact, taken together with the circumstance that her blood coagulability was markedly diminished, suggested that we had before us not a recurrence of the lupus, but a chilblain on the nose. This inference was confirmed when the swelling and reddening of the nose, and in association with this the chilblains on the fingers, rapidly disappeared under the influence of calcium lactate.[1]

It may quite well be that variations in the size of tubercular glands, and perhaps changes in the amount and effusion in tubercular joints, may in similar manner occur, independently of any progress or regress of the infection directly as the result of changes in the coagulability and viscidity of the blood.

(b) *The clinical symptoms in connection with the focus of infection, even when they convey accurate information with respect to the conditions which there obtain, may suggest to us quite a wrong mental picture of the conditions which obtain in the circulating blood.*

I have often pointed out that we have no right to assume

[1] *Vide* author's paper: "On the Pathology and Treatment of Chilblains,' *Lancet*, Jan. 30, 1897.

from the fact that the conditions in a patient's blood are unfavourable to the growth of microbes that we have conditions unfavourable to their growth also in every other region of the body. Where the conditions in a nidus of bacterial infection have been investigated, it has almost invariably turned out that these have been much more unfavourable to the destruction of micro-organisms than those in the blood.

Into the reasons of this I propose, in the second part of this paper, to go more fully. For the present it will suffice to point out that it follows directly from the fact of the conditions in the blood differing from those in the nidus of infection, that the local symptoms cannot—even in case they convey to us an accurate account of the conditions of the microbial infection in the local focus—give us a true measure of the conditions which obtain in the circulating blood.

The significance of this conclusion cannot escape you. You will appreciate that, inasmuch as the object of all inoculations is to operate on the condition of the blood, and inasmuch as that success or ill-success of inoculations can be judged only by the effect which is exerted on the blood, and inasmuch as the symptoms which manifest themselves in the focus do not furnish an unfallacious index of the condition in the circulating blood, we have not in those symptoms any unfallacious guide for control of the dosage.

(c) *The fact that the patient's general clinical condition remains undisturbed does not warrant us in assuming that the antibacterial potency of his blood is not undergoing momentous fluctuations under the influence of spontaneous auto-inoculations.*

We have just seen that the observation of the focus of infection is capable of suggesting to us quite a false idea of the effect that has been produced upon the blood by inoculation. Equally important is it for us to appreciate that we may be led quite as far astray if we take it upon ourselves to infer, from the fact that the patient has remained free from constitutional disturbance, that his blood has not, under the influence of spontaneous auto-inoculations, undergone alterations such as the immunisator ought to take into account in regulating his dosage and in interspacing his inoculations. Again we should fall into error if we were to assume of every slight constitutional disturbance that it must stand in con-

nection with an auto-inoculation. From the responsibility of guessing in such a case, and from the dangers of guessing wrong there would seem to be no way of escape except that which is provided by blood examinations.

Thus far I have spoken only of the case of a localised infection which gives to the clinical observer notification of every change which occurs in its condition. We have next to consider the case where changes in the focus of infection do not manifest themselves either rapidly or clearly upon the clinical record.

(2) *The case of a strictly localised infection where the conditions are unfavourable to the observation of changes in the condition of the focus of infection.*

Typical examples of the class of local infections I have here in view are furnished by the majority of cases of tubercular adenitis, tubercular arthritis, lupus, and pulmonary phthisis. Here we are dealing with processes which are so slow in their evolution that one cannot, between one day and the next, or between one week and the next, or even it may be between one month and the next, make certain whether there has been progress or regress.

It is, of course, obvious that the clinical symptoms in connection with the focus of infection will ultimately tell us whether vaccine therapy has been of benefit, or has been productive of harm, or, as the case may be, that it has effected no sensible change in the focus of infection. But information which arrives thus tardily, arrives too long after the event to be of service. It is from the point of view of its unfruitfulness to the patient to be classed almost in the same category as the retrospective information which the physician derives from his post-mortem examinations and his case-mortality statistics.

For where we discover, only after a long sequence of inoculations, that the scheme of dosage which was adopted was appropriate to the conditions of the case, we have no certainty that the situation has remained the same and that the same scheme of dosage is still appropriate. The verdict of the clinical symptoms on that point will, if the inoculations are continued, be furnished only after another period of months, and then the problem will once more present itself and the answer will once more be postponed, and so on indefinitely.

Again, where we discover, after a long sequence of inoculations, that sensible harm has been done, we learn only that our scheme of dosage has been ill-chosen, but we do not know in what direction to seek for a better scheme. In like manner where, after a long sequence of inoculations, we discover that the condition of the focus is unaltered, we do not know whether some of our sequence of inoculations have been benefiting the patient or whether others may not have been doing him harm, or whether they have all been ineffective. I can put this to you in a form which will be more easily remembered. It is not on every Saturday night that God sends in the reckoning. That is the dominating fact in the situation in connection with the class of cases we are now considering. Here the reckoning is presented to us only at long intervals. And this also is to be kept in view, that the reckoning is presented to us, not in the form of a detailed account with each item set out with its profit and loss, but only as a grand total. It will, therefore, be the part of a prudent man not to await the rendering of the account, but to make inquisition for himself, and to find out from time to time how his account stands.

(3) *The case of an acute febrile condition.*

In the respect that we are here face to face with a pathological phenomenon, whose course can be continuously followed by the clinician, the case of an acute febrile condition presents analogies with the case of a localised infection which has an acute evolution, and which is directly accessible to inspection. In fever we have, in the readings of the clinical thermometer, a means of judging of the results of our inoculations which is of equal value with the indications which are, in the cases of localised infection, afforded to us by a direct inspection of the focus.

While the temperature curve is a measure of intoxication and not of immunisation, and while there is no direct and constant relation between the temperature curve and the production of antibacterial substances in the organism, we may take it that a diminution in the antibacterial potency of the blood generally leads to a multiplication of microbes in the system, this to increased intoxication, and this, in its turn, to a rise of temperature. In like manner, we may take it, that an increase in the antibacterial potency of the blood leads,

as a rule, to a restriction of microbial growth in the organism, this to diminished intoxication, and this, in its turn, to a reduction in the temperature. But while it is the rule to find this inverse relation of temperature to antibacterial potency, it is certainly not the invariable rule. It is notorious that excessive intoxication may condition a fall in temperature; and it is conceivable that a rise in temperature may sometimes be directly associated with efficient immunising response.

We must, as in connection with localised infections so also in connection with pyrexia, be on our guard against the fallacy of mixed infection. Just as the aggravation or persistence of clinical symptoms in connection with a local focus may sometimes be imputable to an intercurrent, or already pre-existing but subordinate infection, so here, in connection with pyrexia, a rise or fall of the temperature may sometimes be imputable to a bacterial infection other than the one which is being combated.

(4) *The case where all local and general symptoms are in abeyance or have returned to the condition which prevailed previous to inoculation.*

The case I have here in view may be encountered indifferently in connection with the three classes of infections considered above.

In connection with the first class of infection, and let us here take the case of a furuncular infection, the situation arises when, after the disappearance of all active furuncles, a condition of uncertainty prevails as to whether the patient is now immune, or whether he is still liable to suffer at any moment from a recurrence of his troubles.

In connection with the second class of cases, let us say, in the case of a tuberculous joint, the problem presents itself where the clinical symptoms have quieted down, and we are left in a state of uncertainty whether the infection has been eradicated or whether it still persists. In connection with a pyrexial infection, we are confronted with the difficulty when we are called upon to decide whether the invading microbes have been eradicated or whether there is still liability to recurrence.

It will be manifest that in none of these situations—and let us note that situations such as these must sooner or later

arise in connection with every immunisation which is progressing towards recovery—can the immunisator obtain any guidance or help from clinical methods.

Résumé of the conclusions which have been arrived at.

Let me now try to sum up to you very briefly the main conclusions which have been reached in our inquiry as to how far, and in what kind of case, the clinical symptoms enable us to correct and control the dosage of our vaccines.

Pro hac vice, I may perhaps with advantage discard the vocabulary of science for the vocabulary of metaphor.

(1) Where it is a question only of a short passage, or, as the case may be, of a succession of short passages, with landmarks continuously in view, over familiar waters where, while stranding is not out of question, serious shipwreck is unthinkable, it would be ridiculous to insist that the pilot should keep the lead going, and should set his course by compass readings. On the other hand, even here, if, as often happens, the landscape becomes indistinct, or is temporarily obliterated, the only rational alternative to anchoring and waiting for the reappearance of the landmarks would be to proceed by compass readings and by the lead.

(2) Where it is a question of a protracted voyage, during which no sequence of guiding landmarks could be expected to come into sight, it is desirable that compass readings should be taken every time that the ship is put upon a new course, or, if that should be impossible, always at the very first warning of impending danger. For otherwise the vessel might very easily zigzag about to no purpose, or she might, if the error in shaping her course happened to be a cumulative one, go very far out of the right track and come to serious disaster.

And we must here beware of thinking that the possibility of error in connection with the laying off of the ship's course is the only possibility of error which we have to take into consideration. There are cases in which the ship may be flung violently off her course by the buffeting of winds and seas. And there are cases where, under some bias of wind or current, the ship may come off her course in a perfectly insensible manner. She may then easily run on the rocks if we do not lay out our bearings by the help of the compass.

(3) Where it is a question of navigating through specially perilous and uncharted waters, where a wrong turn of the helm might at any moment bring disaster, he would be a very imprudent and reckless seaman who would dispense with the aid of lead or compass, even when there were landmarks in sight. Continuous soundings might here quite well give us timely warning of dangers, of which, even with a good look-out, we might be unaware until we had already run in amongst them. Nor would the prudent seaman discard compass and lead until the vessel had come safely into harbour, or until, as the case might be, all efforts to save the ship had been abandoned.

My metaphor will have accomplished its purpose if it has brought home to you that, while we can in many cases conduct our immunisations aright by relying on the experience gained in the past, and upon clinical observation, there are whole classes of cases—these being cases where the only hope for the patient is to be found in the proper conduct of immunisation procedures—where the clinical symptoms cannot be trusted to furnish the necessary guidance.

If this is so, it will be well for us to consider how it has come about that the clinical symptoms have been proclaimed to be an all-sufficient guide. I suggest that the explanation of this is to be found, not in any doubt as to the reality of the risks which might be incurred by the administration of excessive doses of vaccine, but in the persuasion that, if only the glaring errors which were committed in connection with the original inoculations of Koch's tuberculin are avoided, the results of vaccine-therapy will be, on the whole, satisfactory. Associated with this is, I submit, also the further persuasion, that where failures occur the responsibility for these need not necessarily rest with the immunisator, and that such responsibility can at any rate never be brought home to him.

I see nothing to censure in this attitude. It is clearly an attitude which conforms in every point to the accepted code of medical ethics. But, at the same time, I cannot conceal from myself that in every other department of practical life—let us think, for instance, of shipping or railways or any engineering industry—a much higher standard of responsibility is enforced. It is only in connection with medicine that the expert is content to aim at an average of

satisfactory results; it is only in medicine that he thinks efforts to secure uniform success uncalled for; and it is only in medicine that he contends that he has at disposal all the information he requires for his guidance, when a moment's consideration would make it clear to him that he is taking risks, and is proceeding in the dark.

I make no doubt that this will not go on for ever, and that the higher standard of responsibility, which is enforced everywhere else in civilised life, will be enforced also in medicine. It will be enforced then when we shall have shaped it into something more like a scientific profession.

We have here come, as you will immediately perceive, face to face with the critical question as to whether vaccine-therapy has been placed upon a definite scientific footing by the technique, which, in conjunction with Leishman, Douglas, and others of my fellow-workers, I have elaborated for measuring the changes in the blood which follow upon inoculation. I refer here in particular, but not exclusively, to the technique for the determination of the opsonic index of the blood.

Does the technique for the determination of the opsonic index furnish to the immunisator accurate and useful information with respect to the way in which the patient is progressing?

It will not have escaped attention that while the statements, which my fellow-workers and I have made with respect to the accuracy of the opsonic technique and the diagnostic value of the opsonic index, have been fully confirmed by a large body of workers, the technique has, by certain authors, been denounced as flagrantly inaccurate, and it has been confidently asserted, and with an imposing show of figures, that there is no difference between the blood of the infected and the uninfected man in the matter of its power of inciting phagocytosis.

The proper reply to such assertions is to set out a large number of duplicate experiments and counts showing the consistent results which the technique yields in the hands of competent workers, and then to leave it to the authors, who have obtained only inconsistent results, to explain whether their results are to be ascribed to a want of intelligent appre-

ciation of the principles of the technique, or to an incapacity for that conscientious attention to detail which the technique exacts, or to a bias which leads to the scamping of the precautions which are required for the avoidance of error.

My friend and fellow worker, Dr. Alexander Fleming, has been good enough to come to my aid in this matter, and to extract from our laboratory records a large number of control experiments which were made in the course of our ordinary work. He has supplemented these by carrying out, both independently and in association with others of our laboratory workers, a large number of further control experiments. Dr. Fleming has taken upon himself the labour of investigating, in a methodical manner, the effect of certain errors in technique, and, in particular, the effect of a fallacy in connection with the agglutination of red blood corpuscles which has been recently encountered by us. The results of these inquiries will be found set out in a paper which appears in this number of THE PRACTITIONER.[1]

The results,[2] which are there placed on record, demonstrate

[1] *See* page 607.

[2] While these, which concern the only vital points in connection with the technique, are fully set forth in Dr. Fleming's paper, there are two further points in connection with the measurement of the opsonic index which are reserved for further study. The *former* of these relates to the question as to whether trustworthy results can be obtained by the opsonic technique in cases where the patient is suffering from severe bacterial intoxication. The *second* question as to whether estimations of the opsonic index made in different laboratories ought, given accurate work, to show the same close agreement as duplicate estimations made in the same laboratory.

Question as to whether trustworthy results can be obtained by the opsonic technique in cases where the patient is suffering from a severe bacterial intoxication.

A priori considerations would suggest that, in cases of severe bacterial intoxication, and the same applies to "absorption experiments" made to test the specificity of the opsonins of normal blood—there may quite well come into consideration in addition to such effect as may be exerted upon the bacteria by the opsonins of the serum also a toxic effect exerted upon the leucocytes by the bacterial toxins in the serum. At any rate, whether this is the explanation of the matter, or whether that explanation is to be sought in the non-exclusion of the fallacy of hæmagglutination which is wont to occur in such cases, it is to be observed that, in two series of experiments, which were undertaken in our laboratory collectively by the staff and by some workers who were attending the course of instruction, very inconsistent results were obtained with the bloods derived from two patients who were suffering from severe bacterial intoxication, while the results obtained in the case of the control bloods showed in both cases almost ideal agreement.

in a conclusive manner that in connection with tubercle—and it is only in connection with tubercle that the accuracy of the method has been specifically called in question—the opsonic technique gives, in competent hands, extremely consistent results, and that it gives these, not only in the case of normal uninfected persons, but also in the case of the infected persons with whom we have dealt in our hospital.

I need not say any more but pass on to consider the utility of the information furnished by the opsonic index. This may be considered under two headings. We may consider first what has been learned in the way of principles and facts of general application by the measurements of the opsonic index, and secondly what help is furnished by esti-

Question as to whether estimations of the opsonic index made with different cultures in different laboratories ought, given accurate technique and accurate work, to show the same closely concordant results as may properly be exacted in the case of duplicate estimations made with the same cultures in the same laboratory.

While it is of course well understood that where an opsonic index is to be determined, exactly comparable quantities of serum, exactly comparable quantities of phagocytes and exactly comparable numbers of bacteria must be employed in the tubes which correspond respectively with the patient's blood and the normal blood, there is a further theoretical requirement which has been overlooked. Where duplicate pairs of experiments, undertaken with different bacterial suspensions, are to give concordant results, the microbes employed must in each case be comparable from the point of view of their power of resisting phagocytic attack. Now we are not entitled to assume of all the tubercle cultures, which might come into application in different laboratories, that they correspond in this respect; and it is *a priori* probable that this property may be modified to a varying extent by the different treatments to which the cultures may be subjected in different laboratories. While this possibility must always be kept in view, it would appear, from such control-experiments as we have carried out, that the mode of culture and the mode of preparation does not in the case of the tubercle bacillus make any important difference, if indeed it makes any, in the opsonic index arrived at.

It is quite otherwise in the case of certain other microbes, in particular in the case of the bacillus coli and the meningococcus. Here (and this has already been pointed out by Houston in connection with the meningococcus) very different results may be obtained when bloods are tested with different cultures all derived from the same stock. For in association with the attenuation which these microbes undergo upon artificial media they gradually become less and less resistant to the phagocytic attack of the normal blood. A comparatively low index is now obtained where before a very high index was obtained, the result being of course simply due to an increase in the denominator in the fraction:

$$\frac{\textit{phagocytic count of the patient's blood}}{\textit{phagocytic count of the normal blood.}}$$

mations of the opsonic index in connection with the treatment of a case.

A few words will suffice in connection with each of these questions. In connection with the former, I would draw your attention to the fact that—if we except the case of immunisation against typhoid where the changes in the bactericidal and agglutinating powers of the blood have served as a guide—almost everything that we know of the laws which govern the immunising responses which are evoked by bacterial vaccines in man, everything that we know of the phenomena of auto-inoculation, and everything that we know with respect to the proper dosage of our vaccines, are all derived from the opsonic index.

If any light has been thrown on the machinery of immunisation in man; if it has been possible to substitute for the excessive doses of tuberculin which were originally employed, as a first step, the maximal doses which could be administered without injury, and afterwards, both in connection with tuberculin and in connection with a number of other bacterial vaccines, the minimal doses which can be employed with effect, and if we are now in a position to interspace our doses of vaccines in connection with scientific principles—all this is due to the technique of the opsonic index.

When we turn from the general to the particular and ask what help we can gain from the determination of the opsonic index in connection with the treatment of individual cases, I would point out that we can, by the aid of the opsonic technique, determine for each individual case exactly the same points, in connection with the dosage, as have already been determined by the technique for the average case.

Knowing as I do full well that we have not in the opsonic readings anything even remotely comparable with the sextant and chronometer observations, patent log readings, and enumerated revolutions of the screws by which the position of an Atlantic liner is fixed from hour to hour as she crosses the ocean, I was, as you will perhaps have remarked, careful when I was employing the language of metaphor to speak of the measurement of the content of the blood in protective substances as analogous to the soundings and compass bearings

of the navigator rather than to the more highly developed methods of nautical science.

While the modern navigator is in a position, in most cases, to prick off his position upon the chart with accuracy, the immunisator of to-day, less fortunate because less well equipped with scientific methods, can at least tell by his measurements of the opsonic power, or, as the case may be, by his measurement of any of the other protective elements of the blood, whether he is shaping a proper course for his patient, and whether his patient is keeping on that course.

Let me now pass to consider the second division of my subject-matter.

PART II.

How may such antibacterial agencies as the patient may already be possessed of, or may acquire by immunisation, be directed to the destruction of microbes in the focus of infection?

Where inoculations are undertaken for prophylactic purposes, the immunisator is not required to make any dispositions for bringing the antibacterial elements of the blood fluids and the phagocytes into application upon invading microbes. They will come into application in a perfectly automatic manner.

Exactly the same thing holds true in connection with vaccine-therapy where the invading bacteria have not as yet effected any fundamental alterations in the invaded tissues.

Entirely different is the situation when vaccine-therapy is resorted to in cases, where the invading bacteria have already firmly ensconced themselves, and have profoundly modified the conditions in the focus of infection. Here it will not suffice to increase and maintain the antibacterial power of the blood. It will be necessary in each case to take special steps to bring the phagocytes and antibacterial elements of the blood fluids to bear upon the invading micro-organisms.

Before we can profitably consider what these steps ought, in each particular case, to be, it will be well to take a general survey of the conditions with which we have to deal.

We may study, *first*, the distribution of the antibacterial agents in the normal organism; *secondly*, the inflammatory reaction which supervenes upon a bacterial invasion of the

tissues, and the changes in the distribution of the antibacterial agent which are associated with that reaction; and, *thirdly*, the conditions which present themselves when microbes have survived the inflammatory reaction, and have made for themselves a nidus in the tissues.

General question of the distribution of antibacterial agents in the normal organism.

In the circulating blood the organism has at immediate disposal practically the whole of its defensive forces. It has here at disposal, on the one hand, the bacteriotropic substances which are contained in the plasma and, on the other hand, its whole force of phagocytes.

It follows that where microbes make their way into the blood stream there will come into application against them, not only a superabundance of phagocytes, but also a superabundance of bacteriotropic substances. These last will operate upon the bacteria with a mass effect which will be continuously kept up to a level corresponding with the full bacteriotropic pressure of the patient's blood.

Where, on the contrary, the microbes effect an entrance into the tissues, they will find opposed to them, for the moment, only such stray phagocytes as may be casually passing through the tissue spaces which are the subject of invasion, and only such quantum of antibacterial substances as may be contained in the lymph which is flowing through these particular tissue spaces.

It is, in view of these considerations, immediately intelligible that the animal organism should, as it does, successfully resist microbes, administered through the channel of the blood, when it fails to offer resistance to the selfsame microbes, administered by way of the tissues. It is also in conformity with these considerations that localised infections should be ordinary every-day events, that these localised infections should only very rarely lead on to secondary septicæmia, and that primary septicæmic infections should be of comparatively rare occurrence.

From these general considerations, we may also draw the lesson that, in all cases of localised infection, the aim and object of our treatment ought to be to level up the conditions in the infected tissue to the conditions in the circulating blood.

Nature of the inflammatory reaction which supervenes upon a bacterial invasion of the tissues, and changes in the distribution of the antibacterial agents which are effected by that reaction.

No one who has perused the illuminating lectures in which Metchnikoff discourses on the Comparative Pathology of Inflammation will fail to call to mind his great generalisation that everywhere through the invertebrate and vertebrate kingdoms the intrusion of bacteria or other foreign elements into the tissues is responded to by a determination of phagocytes to the seat of injury. Nor will anyone who has read those lectures have forgotten that Metchnikoff there contends that the phagocytes are the only antibacterial agency, and that in the emigration of phagocytes is to be found the whole import of inflammation.

Since the publication of the lectures, we have in connection with immunity been moving on to new view-points. Much has since then been learned about the antibacterial powers of the blood fluids, and in particular the work of Douglas and myself has shown that phagocytes, when unaided by the opsonic power of the blood, are comparatively impotent. It has accordingly become impossible to confine our attention, as did Metchnikoff in his lectures, to the phagocytes, and to regard these as alone significant, overlooking the increased transudation of fluid from the blood vessels which invariably accompanies inflammation, or setting this aside, as Metchnikoff did, as a phenomenon to which no special significance was to be attributed.

In short, we can no longer see in the transfer of phagocytes from the circulating blood to the invaded tissues the whole import of inflammation. Rather we must to-day recognise in inflammation a process which ministers to immunisation, on the one hand, by the transfer of phagocytes, and, on the other hand, by the transfer of antibacterial fluid from the circulating blood to the invaded tissues.

When we correlate with this view of inflammation the therapeutical principle which was borne in upon us by the consideration of the distribution of the antibacterial agencies in the normal body, it becomes clear that the therapeutical principle in question—I mean the principle of levelling up so far

as may be the conditions in the invaded tissues to those in the circulating blood stream—is neither more nor less than a policy of bringing intelligent aid to nature, and furthering the defensive measures by which the organism responds to bacterial invasion.

Moreover, it will presently appear that while the original theory of Metchnikoff failed to furnish any explanation of the frequent ineffectiveness of the inflammatory reaction, the theory of Metchnikoff as here amended puts into our hands a key which unlocks the problem of the frequent miscarriage of the inflammatory reaction, supplying at the same time indications as to how such miscarriage may be rectified.

Conditions which present themselves in the case where microbes have survived the inflammatory reaction, which has supervened upon their invasion, and have established themselves in a nidus in the tissues.

A nidus, in the sense in which I here employ the term, is constituted whenever, as the result of the miscarriage of an inflammatory reaction, and of changes in the tissues and products of inflammation, conditions are established in the focus of infection which are specially favourable to the infecting microbes.

We have here to consider (1) the conditions which are common to every bacterial nidus; (2) the conditions which are special to particular types of bacterial nidus.

(1) *Conditions which are common to every Bacterial Nidus.*

Common to every bacterial nidus is the circumstance that the effective access of phagocytes and bacteriotropic substances to the infecting microbes is in some way hindered. The impediment may consist in any of the following:—(*a*) a defective blood supply to the seat of infection; (*b*) a hypercoagulable and hyperviscid condition of the blood, for this would impede transudation of fluid from the blood vessels and would be favourable to the coagulation of effused lymph in the tissue spaces; (*c*) an accumulation of excessive fluid in the focus, for this would prevent the phagocytes coming in contact with the bacteria; (*d*) a blocking of the tissue spaces by accumulated leucocytes and coagulated lymph, for this would constitute a mechanical hindrance to the entrance of fluids and phagocytes into the focus of infection; (*e*) a stagnation of lymph in the

focus of infection, for this would lead to a gradual reduction of the antibacterial potency of the lymph, which would render the phagocytes ineffective, and an accumulation of bacterial toxins and tryptic ferment which would paralyse the phagocytes.

(2) *Conditions which are special to particular Types of Bacterial Nidus.*

When we have appreciated that inflammation is associated with a transudation of blood fluids and an emigration of phagocytes, and when we have appreciated that inflammation may be associated with hyperplasic changes in the tissues, and may be complicated by secondary changes in the products of inflammation, and when we realise that one or more of these factors may predominate over the others, it will inevitably come home to us that we must expect to meet a number of different types of nidus, each corresponding with an inflammatory reaction which has miscarried in some special way, and each possessing characters which are special to itself.

The more important cases with which we have to deal are the following :—

(*a*) the case where serous effusion is the characteristic feature in connection with a nidus of infection ;

(*b*) the case where the tissue spaces in the nidus of infection are blocked with leucocytes and coagulated lymph ;

(*c*) the case where suppuration has occurred in the nidus of infection, and an abscess sac has been formed ;

(*d*) the case where in connection with a microbic infection of the skin a nidus has been formed under the shelter of a scab ;

(*e*) the case where a nidus of infection has been formed on the surface of granulation tissue.

We may consider these cases seriatim.

(*a*) *Conditions which obtain where serous Effusion is the Characteristic Feature in connection with a Nidus of Infection.*—In connection with serous effusion, it is important to call to mind that, if we except the typhoid bacillus and the cholera vibrio, all the other pathogenic germs which come into consideration in connection with human pathology have, so far as they have been examined, proved completely resistant to the bactericidal action of the blood fluids. It is an obvious corollary to this that any inflammatory reaction, which begins and ends in a

serous effusion, must practically always be an ineffectual reaction. Furthermore, it will be plain to consideration that where serous effusion predominates over phagocytic reaction to such an extent as to make it difficult for the phagocytes to find and possess themselves of the bacteric, the excess of effusion must constitute a hindrance to the destruction of these by the agency of the phagocytes.

There is yet a further point which has to be borne in mind in connection with serous effusion. It is now a familiar matter that when microbes are brought in contact with the blood fluids they rapidly absorb from these the bacteriotropic elements for which they have a chemical affinity. It is a corollary to this that wherever within the organism a serous effusion stands in contact with bacteria, it will lose more and more of its anti-bacterial potency. Douglas and I have shown that it actually does so.

(*b*) *Conditions which obtain where the Tissue Spaces in the Nidus of Infection are blocked with Leucocytes and with Coagulated Lymph.*—The conditions, which we have here to consider, may be regarded as the direct converse of the conditions which are met with in connection with serous effusion. Whereas there we had a preponderance of transudation over emigration, here we have a preponderance of emigration over transudation ; and, whereas there the effused lymph had little tendency to clot, here the effused lymph clots in the tissues binding the inflammatory products together into a consolidated mass.

Inflammatory reactions which eventuate in this manner may be met with both in animals and man. In the rabbit, for instance, pus would appear normally to take the form of a solid cheesy mass, consisting of leucocytes held together by meshes of fibrin. In man the inflammatory products take this form only under quite special conditions. They do so in acute infections of the lungs, perhaps most characteristically in croupous pneumonia. There, as you know, we have in the alveoli of the consolidated lung not fluid pus, but a solid inflammatory product consisting principally of polynuclear leucocytes embedded in a meshwork of fibrin. A quite similar fibrinous pus may be formed also in the spaces of the subcutaneous tissue. Where we speak of a carbuncle, or of brawny infiltration, or simply of induration in connection with any

pyogenic invasion, we are in reality speaking of lesions which are characterised by a more or less complete infiltration of the tissue spaces by a fibrinous pus.

If we now ask ourselves in what manner the blocking of the tissue spaces by a consolidated pus will influence the survival of the invading bacteria, the answer immediately suggests itself. Such blocking of the tissues will prevent, or render difficult, the conveyance of any additional lymph or of any reinforcing phagocytes into the focus of infection. If now the phagocytes which are on the spot have, owing to deficient opsonic power in the lymph originally effused, been from the outset ineffective; or, if having originally been effective, they have been confined by the coagulation of the lymph, or have been rendered ineffective, either directly by the accumulation of bacterial toxins, or indirectly by lymph gradually losing its opsonic potency; it will be intelligible that the invading bacteria should—in the interior of the infiltrated tissues—be able to maintain themselves safe from attack, at any rate, until such time as the barrier against the protective agencies of the organism shall have been broken down by the sloughing of the infected tissues.

(*c*) *Conditions which obtain in the case where Suppuration has occurred and an Abscess Sac has been formed.*—What occurs in connection with suppuration and abscess formation would seem to be as follows:—

When the leucocytes disintegrate in the focus of infection—and they will die and disintegrate not only under the influence of the bacterial toxins which are generated, but also independently of this—there will, as has been shown in a masterly manner by Opie, be liberated in the focus of infection larger and larger quantities of tryptic ferment, until finally the antitryptic power,[1] which the lymph possesses when it

[1] It may be of interest here to briefly describe a simple technique by which the tryptic potency of the leucocyte when isolated from the blood fluids, and the anti-tryptic power of those fluids may be demonstrated and measured. For the demonstration of the tryptic power of the leucocyte we may have recourse either to leucocytes isolated from pus, or to leucocytes isolated from the circulating blood. Where we are concerned to avoid sources of error from bacterial contamination and to employ irreproachable leucocytes, we may most conveniently have recourse to the circulating blood. The procedure which will be appropriate will be indicated by the following instructions:—

Take a piece of glass tubing, about three-fifths of an inch diameter and

transuded from the blood vessels, is overpowered. When this condition is arrived at and the pus fluid has become definitely tryptic, the trabeculæ of connective tissue between the tissue spaces, together with any strands of fibrin which may envelop

2 to 2½ inches long. Draw it out at one end into a capillary stem forming thus a pipette with a moderately long barrel-shaped upper extremity. Employing a rubber teat and placing a mark upon the stem, draw up first any convenient measured quantity of blood (say, 50 to 100 cmm.) into the pipette, and then 5 volumes of distilled water. Mix in the barrel of the pipette and then seal off the capillary stem a little below the point where it expands into the neck, and place the diluted hæmolysed blood, which will thus have been obtained, in an incubator at 37 C. Leave it there for 30 minutes. Now, using another capillary pipette, direct a stream of water on to the clot which will have formed and continue washing the clot and removing the wash water until a contracted and almost colourless clot shall have been obtained. (Microscopic examination of such a clot shows that it consists of a solid mass of leucocytes embedded in a meshwork of fibrin.) Now liquefy some 10 to 15 per cent. gelatine—a tube of the nutrient gelatine which is employed as a culture medium will serve for this purpose—and taking up in a pipette a measured volume of this, corresponding with, say, 2 to 2½ times the volume of the undiluted blood which was employed, introduce this into the tube which contains the washed and drained clot. Now seal the upper end of this tube in the flame and place in an incubator at a temperature of 50 to 55 C., which is the optimum temperature for a tryptic digestion.

Prepare, using in each case exactly the same volumes of blood, distilled water, and gelatine, a whole series of tubes. Into certain of these introduce, mixing carefully with the gelatine, a measured volume of normal serum corresponding with ¼ to ½ the volume of the blood originally employed.

After incubating the tubes at 50 to 55 C for 2 to 3 days—that interval of time is required to allow of the disintegration of the leucocytes—examine the condition of the clot in the tubes, and place these upright in cold water or on the laboratory bench so as to give opportunity for the solidification of the gelatine. It will now be found that the clot will have disintegrated and the gelatine will have lost its power of setting in the case of the tubes which contain only gelatine and clot, while in the tubes which received an addition of serum, the tryptic action will have been inhibited with the result that the clot will be intact and the gelatine will have retained its power of setting.

The measurement of the tryptic or anti-tryptic power of a fluid may be carried out by the aid of throttled pipettes and the technique for progressive dilution, mixture and storage which I have described in connection with the measurement of the agglutinating power of the blood (*Lancet*, July 25, 1903).

Into companion throttled pipettes there would be introduced (combined in he one case with serum and in the other case with an equivalent of water) progressive dilutions of the tryptic fluid mixed in each case with indicator fluid. That indicator fluid would consist of a milky suspension of very fine floccules of coagulated albumen, such as is obtained by heating a normal serum diluted sixfold with a very attenuated acetic acid. The clarification or, as the case may be, non-clarification of such a fluid by the progressive dilutions of the digestive fluid renders manifest to the eye the action of the digestive ferment or the inhibition of its action.

the leucocytes are rapidly dissolved, with the result that an abscess sac is formed and definite fluctuation is obtained. The pus fluid may now proceed to eat into the surrounding tissues, and then either burrow in the depth or point upon the surface.

Of these facts those which are material in connection with the survival of the infecting microbes are the following :—The fluid in the abscess sac, being more or less completely shut off from the circulating lymph by a barrier of infiltrated tissue, furnishes a nidus for the growth of bacteria. Under the influence of those bacteria, the lymph in the nidus, which originally possessed both antibacterial and antitryptic properties, becomes first impoverished in antibacterial elements, then charged with bacterial products and finally (in particular where pyogenic micro-organisms, as distinguished from tubercle bacilli, are at work) endowed with tryptic properties. It will be clear, *a priori*, on consideration of these facts, that fresh phagocytes (should such arrive upon the scene) would, even, if they escaped paralysis by bacterial toxins and digestion by the tryptic ferment, find in the abscess fluid no opsonic substances to co-operate with them.

The sequence of events which has just been described can, as a matter of fact, be readily followed by direct examination. While in the early stages which precede abscess formation phagocytosis may be encountered, microscopic examination of pus after an abscess has been formed will practically always show that the leucocytes have degenerated, and that phagocytosis is entirely absent. And separate examination of the leucocytes and the pus fluid shows, in the case of the leucocytes, that, even after they have been washed and have been furnished with normal serum, they are incompetent to ingest bacteria, and in the case of the pus fluid that it paralyses healthy leucocytes, and that it is incapable of exerting any opsonic action upon bacteria which are obtained from the abscess.

(*d*) *Conditions which obtain where in connection with a Microbic Infection of the Skin a Nidus has been formed under the Shelter of a Scab.*—A word or two will serve to make clear the conditions which obtain where a surface infection has led to the

formation of a scab. It will be appreciated that the outflow of lymph from the superficial vessels, which is associated with inflammatory response to a superficial infection, staunches as soon as the lymph begins to coagulate on the surface, and is definitely arrested when the coagulated lymp desiccates and hardens into a scab. In association with this, such phagocytes as may be contained in that lymph will be, in the first instance, immobilised, and then killed by desiccation. It will be quite otherwise with any surviving bacteria. These, when they become involved in the scab, will be sheltered from the attacks of the phagocytes. If now they succeed in multiplying in the deeper and correspondingly moister layers of the scab, they will reduce the antibacterial potency of the comparatively stagnant lymph which underlies the scab and will then be in a position to invade the underlying subcutaneous tissue or epithelium, and thus to extend the area of infection.

(*e*) *Conditions which obtain in the Case where we have to deal with a persistent Sinus.*—Where a sinus is freely discharging pus the conditions are, I take it, not dissimilar from those which prevail in an abscess. The pus, in such a case, possesses a low opsonic power, it contains no effective leucocytes, it may be charged with bacterial toxin, and it contains—as a glance at the sodden and digested appearance of the skin-surface in the neighbourhood of a discharging sinus informs us—a tryptic ferment.

In the case of a sinus which does not furnish any discharge we have, I take it, to deal with conditions somewhat comparable with those which would obtain in a well in the case where the inflowing water had deposited on its walls an insoluble element in such a manner as to choke all the conduits of inflow. Upon the walls and floor of such a well forms of life might quite well maintain themselves, which would be incapable of holding their own in the face of a copious inflow of water. So is it, I take it, in the case of the dry sinus. Here we may assume that the density of the granulation tissue which lines the walls, and the continual deposition of fibrin upon the surface of that lining membrane, prevent the free outflow of lymph on to the surface.

Consideration of the therapeutic measures by which we may bring the antibacterial agencies of the circulating blood into effective operation upon the microbes in a nidus of infection.

We have already appreciated that the spontaneous cure of localised bacterial infections is effected by the transfer of antibacterial agencies from the circulating blood to the invaded tissues, and we have further appreciated that we can, in those cases of localised infection where a spontaneous cure is not effected, give aid, on the one hand, by increasing the antibacterial resources which are at disposal in the circulating blood, and, on the other hand, by bringing those antibacterial agencies into effective operation upon the bacteria in the invaded tissues. We have here to consider the problem as to how the latter object can be achieved in the case where the invading bacteria have already made for themselves a nidus in the invaded tissues. This will involve the discussion of the measures which may be employed to favour the transfer of antibacterial agencies from the blood to the site of infection, and also the discussion of the measures which may be employed to open the way for the entrance of the antibacterial substances and phagocytes into the nidus of infection.

(1) *Measures which may be employed to favour the Transfer of Antibacterial Agencies from the Blood to the Site of Infection.*—Although it might at first sight seem that it would be necessary, in connection with the transfer of antibacterial agencies from the blood to the tissues, to consider separately the case of the emigrating leucocytes and the transuding lymph, it becomes clear, on reflection, that, inasmuch as increased transudation is normally associated with increased emigration, and, inasmuch as we cannot promote one of these without at the same time favouring the other, it will be both legitimate and convenient to confine ourselves here to the discussion of the means we have at disposal for increasing transudation.

There are, in point of fact, two main factors which come into consideration in connection with lymph—the first is the hydrostatic pressure in the local capillaries, the second is the coagulability and viscidity of the blood. I pass, therefore, to discuss the therapeutic measures we have at command

for raising the hydrostatic pressure in the capillaries, and for diminishing the coagulability and viscidity of the blood.

(*a*) *Measures for raising the Hydrostatic Pressure in the Capillaries of the infected Part.*—It will be clear that, where the focus of infection is so situated as to make it possible to exercise control over the blood which circulates in it, there will be a possibility of increasing the hydrostatic pressure in the capillaries of the infected region, on the one hand, by determining a fuller supply of arterial blood to the affected region, and, on the other hand, by banking up the blood in the veins which carry off the blood from the affected part. We can raise the capillary pressure by the former method if we apply hot fomentations, or heat in any other form, or rubefacients. We can raise the pressure by the latter method if, following the procedure of Bier, we apply a bandage loosely round the limb.

The consideration of the question as to how we can raise the hydrostatic pressure in the capillaries naturally leads on to the consideration of the question as to when and in what circumstances it will be expedient to have recourse to measures for raising that pressure. Two different considerations must here be kept in view. On the one hand, the question as to whether the normal blood-supply to the infected part is capable of furnishing an adequate lymph-stream must be considered; on the other hand, we must weigh the advantage which would be derived from the determination of increased protective substances to the affected part against the disadvantages which might result from the fact that the ampler lymph-stream would carry into the blood bacterial products which were previously locked up in the focus of infection. The decision as to where the balance of advantage lies in a particular case may thus be a very delicate matter. It is in many cases a question which cannot be resolved without a trial supplemented by a series of blood-examinations. It may, however, be laid down as a general working rule that the advantage will be greatest where the bacterial focus is situated in a poorly vascularised tissue, and that the disadvantage will be least (*a*) in the earliest stages of an infection, (*b*) where the bacterial focus is of strictly moderate dimensions, and (*c*) where it has just been evacuated. In the

case where the dimensions of a bacterial focus are considerable, the disadvantages of determining an increased lymph-stream to the affected tissues will generally altogether outweigh the advantages.

(*b*) *Measures for diminishing the Coagulability and Viscidity of the Blood.*—In the course of my studies in connection with the causation of urticaria and other forms of serous hæmorrhage, on the one hand, and thrombosis, on the other hand, I have repeatedly pointed out that a condition of diminished blood-coagulability is associated with increased transudation into the tissues, and that a condition of increased blood-coagulability is associated with restricted transudation and with the transudation of a lymph which is very prone to coagulate in the tissues. I have, further, in connection with the studies here referred to, shown that transudation can be increased or diminished at pleasure by rendering the blood more coagulable by the exhibition of calcium salts or, as the case may be, by diminishing its coagulability by the administration of a decalcifying agent, such as citric acid (citric acid, 4 grammes, t.i.d.).

The fact that diminished coagulability of the blood goes hand in hand with increased transudation of lymph is of interest to us here, inasmuch as it suggests that diminished blood-coagulability may be a factor in the production of serous effusion. The fact that increased blood-coagulability goes hand in hand with diminished transudation of lymph and with a tendency on the part of the effused lymph to clot in the meshes of the tissues, in like manner suggests that a hypercoagulable condition of the blood may be a factor in the production of brawny swelling and carbuncle.

The fact that transudation can be decreased by the administration of calcium salts has a possible therapeutic application in connection with those cases where spontaneous auto-inoculations are occurring in response to a conveyance of bacterial products into the blood by the agency of the lymph.

Lastly, the fact that lymph-transudation may be increased, and the fact that the tendency on the part of a lymph to coagulate in the tissues may be counteracted by the administration of citric acid, has, it seems to me, a very important application in connection with the treatment of brawny

swelling. I have already[1] given details of a case of Ludwig's angina, where an obvious change for better ensued upon the administration of this decalcifying and lymphagogic agent.

In this connection it is interesting to note that our grandmothers employed with success a similar method of treatment in connection with infections of the respiratory passages. They were, as you remember, wont to administer decalcifying draughts of black currant tea for the purpose of "loosening a hard cough," and they often followed these up by another lymphagogue in the form of oatmeal gruel.

(2) *Measures that may be employed to open the Way for the Entrance of Antibacterial Element into the Focus of Infection.*—We have already, in connection with the suggestion that citric acid may with advantage be administered for the purpose of counteracting the clotting of the lymph in the focus of infection, considered one of the measures that may be employed to facilitate the entrance of phagocytes and antibacterial elements into the focus of infection. There are, however, other obstacles to that entrance. There is, in the first place, the barrier which is opposed by the infiltration of the tissues by leucocytes, and there is the mechanical obstacle which is constituted by the accumulation of fluid in the focus of infection. Again, as we have seen, when we were considering the conditions which obtain in abscesses, there are other hindrances, in the form of bacterial toxins and digestive ferments, which interfere with the functioning of the phagocytes. All these obstacles and hindrances can be got out of the way only by resort to evacuation.

We may briefly consider four different methods of evacuation—evacuation by incision; evacuation by aspiration; evacuation by puncture or incision, combined with cupping; evacuation by puncture or incision or removal of scabs, combined with the local application of a chemical lymphagogue.

(*a*) *Evacuation by Incision.*—It is an axiom in surgery that all pus must be cut down upon, and it is almost equally a precept of surgical obligation, to carry free incisions through the infiltrated tissues where an inflammatory reaction culminates, instead of in pus, in brawny swelling or in carbuncle. It is perfectly well understood in the case of abscess—though

[1] *Lancet*, August 24, 1907.

not so well, I think, in connection with brawny swelling or carbuncle—that the object of incision is in all cases the evacuation of the products of inflammation. We have witness to this in the fact that, in the case of suppurative processes, these are postponed until fluctuation is obtained, and in the fact that provision is made for drainage either by opening the abscess at the most dependent part or by introducing tubes into the wound. But, illogically, in the case of brawny swelling, where incision has not resulted in evacuation, the surgeon does not seek a remedy for this condition. And the illogicalty of surgery does not stop here. While in certain cases the evacuation of the contents of an abscess is followed up by measures which bring phagocytes and antibacterial substance from the blood into the evacuated focus—I am thinking here of hot fomentations—in most cases evacuation is regarded as if it were an end in itself, instead of being only a means for bringing the antibacterial protective agencies of the blood into effective operation. And yet where that object is not achieved by incision, nothing has been achieved in the matter of the extinction of the infection. In fact, in such a case, nothing that is worth achieving has been achieved, unless it is the safeguarding of the skin from erosion by the tryptic ferment of the pus or the prevention of burrowing.

(*b*) *Evacuation by Aspiration.*—Between evacuation by incision and evacuation by aspiration there are only few and comparatively unimportant differences. From the point of view of the complete evacuation of the contents of the abscess the advantage clearly rests with the method of incision. From the point of view of the avoidance of an external wound with the opportunity it furnishes for secondary infection, the advantage equally clearly lies with the method of aspiration. There remains only the question of the greater or less freedom of access of antibacterial agencies to the nidus of infection in either case, and the question of drainage. On the whole the advantage would here seem to rest with the method of aspiration, for no sooner is an abscess sac evacuated than it begins to fill up again with an antitryptic, and opsonic lymph, and drainage, if such should prove necessary, is easily provided for by repeating the aspiration.

Evacuation by Incision or Multiple Puncture combined with

Cupping.—The procedure here in question is a procedure which is recommended by Bier and Klapp as useful in connection with the treatment of furuncles and carbuncles and localised tubercular affections. At first sight, this method would seem to furnish exactly the kind of motive force which an immunisator would wish to employ for evacuating the inspissated inflammatory products from the choked tissues, and for drawing out from the blood, and carrying through the infiltrated or hyperplasic tissues, a stream of immunising lymph. Practical experience and reflection however make clear that one requisite to success has here been overlooked. In reality the procedure of Bier and Klapp is a filtration process carried out with the help of an exhaust. And it will be clear that where a viscid and coagulable fluid has to be drawn through a very fine system of pores, the clotting of the fluid in or at the mouths of those pores may very readily bring the filtration to a dead standstill. In the case of a laboratory experiment, the filter, if it is a paper filter, will then bulge and give way. In the case of the animal tissues also, even when the negative pressure is kept within strict limits, there will be bulging, and inevitably something will give way. What will in point of fact give way will be the delicate capillary walls, and in the case of a carbuncle thus treated its last state will, in my experience, be worse than the first.

Evacuation by Incision, Puncture, or Removal of Scabs combined with the local Application of a chemical Lymphagogue.—Attention has just been directed to the defects which must attach to every method which seeks to achieve by mechanical force the evacuation of obtruding material and the passage of a coagulable fluid through a choked filter. There is a more excellent way. If we can either clear the surface of the filter (I am here thinking of the removal of scabs from an infected surface), or pierce through the surface layer of the filter (I am thinking here of incision or puncture into a nidus of infection), and if we can then, without the application of any violence, cause the fluid to well out through the pores, depriving at the same time that fluid of its coagulability, we shall gradually open up, and then keep open our choked filter.

I have already, on more than one occasion, pointed out that we have in a citrated hypertonic salt solution a chemical agent

which will, applied to the surface of any open system of tissue spaces, cause a lymph stream to set outwards through those tissue spaces towards the surface, while it will, at the same time, deprive that lymph of its coagulability. I have suggested that this agent should be prescribed in the form of a powder consisting of four parts of common salt and one part of citrate of soda, with instructions that it should be dissolved when required in 100 parts of boiling water. A concentration of 1·5 to 2 per cent. of salt will, however, in certain cases be preferable, the concentration of the citrate remaining as before at 0·5 per cent.

Where incisions have been carried down into infiltrated tissues, lint soaked in the stronger solution may with advantage be brought into the wounds. In the case where an abscess cavity cannot be effectively drained, the stronger solution may with advantage be introduced into the sac, the fluid which collects being of course, from time to time, evacuated. Whereas in the pus obtained before treatment, phagocytosis will have been absent, it will, if the blood is not gravely at fault, be conspicuous in the fluid which now collects in the sac. Sinuses may with advantage be syringed out with the same lotion, a piece of lint soaked in the lotion being afterwards introduced into their orifices. Here again, after the citrate and salt application, evidence of phagocytic activity will be found on examining the discharge. If not, the fault may with advantage be sought in the blood. Keeping in view the fact that it is always possible, by continuously "drawing," to keep an orifice permanently open, it will be advisable in the case, where we are dealing with a sinus, to suspend the citrate and salt applications from time to time, for a few days at a time, to ascertain what has been accomplished. In the case of a boil or a tubercular abscess, it will be well, after the pus has been evacuated, to apply the citrate and salt solution to the orifice, and to continue to do so as long as any induration persists or any discharge is obtained. The skin in the neighbourhood of the orifice may with advantage be protected against the irritating effect of the brine by a coating of vaseline. In the case where a surface is covered with scab, it will be advisable, after this has been removed, to apply the weaker solutions of citrate and salt, and to continue the applications only for a

few minutes to half an hour. After the wound has in this way been sufficiently washed with a stream of immunising lymph, it will be well to staunch the flow, by powdering the surface with a styptic powder, consisting of calcium chloride 1 part, precipitated chalk 400 parts.

It is, I think, of interest, in connection with these therapeutical applications of the citrate and salt, to state that we have in this decalcifying and hydragogue application only a variant of the soap and sugar plasters which our grandmothers were wont to employ for "drawing" boils. A similar interest attaches to the fact that another of the therapeutic applications of this citrate and salt solution was anticipated by the West Indian slave-owners. I find it recorded of them that it was their practice, when a slave had been scourged and his skin had been cut into ribbons, to prevent the supervention of gangrene by rubbing into the wounds a concentrated brine, fortified by a decalcifying agent in the form of the juice of green lemons, and a further lymphagogue in the form of allspice. It was brutal, but it was very intelligent. Finally, in this connection we may note that brine springs and sea water have acquired, and probably have deserved, a certain reputation in connection with the treatment of scrofulous ulceration.

Organisation of the Medical Profession for carrying out the Work of Therapeutic Immunisation.

In conclusion, a final word may be appropriate on the subject of the organisation of the medical profession for carrying out the work of therapeutic immunisation. I have already said that in the future of my expectation the physician will be an immunisator. I conceive that the task of making, by bacteriological methods, a direct or inferential diagnosis of the nature of the patient's infection, the task of preparing and standardising special vaccines, the task of controlling the output of protective substances by blood examinations, and the direction of immunisation procedures where blood examinations are required as a guide will all fall upon his shoulders. To carry out these difficult and delicate tasks I conceive that the physician will require to be a trained laboratory worker.

But the physician—so I conceive of the matter—will not be the only immunisator.

Upon the general practitioner, when he shall have been trained in the physiology of immunisation, as he is now trained in the physiology of the circulatory system or the digestive system, will devolve, I take it, all such immunisation as it shall be possible to reduce to a system of routine, and all such immunisation as can be effectively conducted under the control of the clinical symptoms.

In addition to this there will, if I mistake not, devolve upon the general practitioner, in association with the surgeon, all that department of immunisation which consists in directing the protective agencies which are available in the patient's blood to the destruction of microbes in the local focus of infection.

And in the future that I foresee, the surgeon also will—I have just hinted as much—be, in a very real sense, an immunisator. He will, I doubt not, except in those rare cases where there is an isolated bacterial focus, and where the complete extirpation of that focus is practicable and advisable, direct all his operations in connection with bacterial disease to the attainment of immunisation. I conceive, for instance, that, where he carries his incision through infiltrated tissues, he will feel that his work remains incomplete till he has secured that free flow from his wounds which is essential to immunisation. Again, when he deals with a suppurating focus, he will, I take it, concern himself not only with evacuation and effective drainage, but will realise that a continued suppuration without the achievement of immunisation in a case which has been operated upon is the reproach of surgery.

And, above all, I anticipate that, while the method of bringing the antibacterial agencies of the blood into effective operation upon microbes in the focus of infection will every day be improved and every day be more and more intelligently exploited, every one, who follows our profession, will come to realise that any such measures must be futile unless where adequate protective substances are at disposition in the blood-stream.

SOME OBSERVATIONS ON THE OPSONIC INDEX, WITH SPECIAL REFERENCE TO THE ACCURACY OF THE METHOD, AND TO SOME OF THE SOURCES OF ERROR.

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It is not my intention here to give any description of the technique employed in the estimation of the opsonic index, as this has been done already by numerous writers, but simply to confine myself to drawing attention to certain of the difficulties which an observer may encounter and pitfalls he may meet. At the same time I propose to bring forward some figures, obtained at St. Mary's Hospital during the last 18 months, which show that consistent results are obtained by the method.

The opsonic index being the ratio of one serum to another which is taken as unity, depends for its accuracy on two factors :—

(*a*) The constancy of the control,

(*b*) The accuracy of the estimation.

Thus, however accurate the method, it would be useless trying to get results comparable from day to day, if the power of the control serum was a variable factor, and so, before discussing any question of the accuracy of the opsonic estimation, I think it would be wise to enquire into the question of the constancy of the control, and to this end I propose to adduce figures to show that, so far at least as the tubercle bacillus is concerned, the resistance of a healthy person is a very constant quality, and the variation is little more than can be accounted for by the experimental error.

Bulloch (*Trans. Path. Soc.*, vol LVI. 1905), using as control his own serum, estimated the opsonic indices of forty-four students and forty nurses at the London Hospital, and of these eighty-four people, seventy-five came out with

indices between 0·90 and 1·10, while of the remaining nine, one had an index of 1·20 and four were as low as 0·80, none, however, going outside of these limits. Series similar to this have been published by other investigators with almost identical results, almost all the indices lying between 0·90 and 1·10, and only differing in the extent of variation of the few outside this. Some had no indices under 0·90 and others none over 1·10, but the sum total of the results is the same.

In Table I. are set forth the results which have been obtained at St. Mary's Hospital during the year, from August 1906 to July 1907, in testing normal sera. In the routine work of the laboratory, the controls used in connection with the estimation of the tuberculo-opsonic indices of our patients are furnished by the various workers in the laboratory, or, as it may be, by interested visitors and students, and these are used in the proportion of one control to every eight or ten patients' sera. Thus, in each day's work, there are three or four normal sera used, and each observer, who engages in counting any of the slides, counts at least two, but often three or even more, of these controls. In this way a double check on the accuracy of working is obtained, as not only is one control serum checked by the others, but one observer's count is at the same time checked by another's count of the same slide.

The figures in the table represent the opsonic indices which are arrived at exactly in the same way as in dealing with a patient's blood, the actual phagocytic count of the slides being divided by the mean of the counts of all the controls counted.

In the table are set forth the indices of 44 healthy people. The number of times which the index of one individual is measured varies from 1 to 193, the whole amounting to 635 estimations.

Of this total of 635 estimations, 0·8 per cent. are under 0·90, 10·1 per cent. are between 0·90 and 0·95,76 per cent. are between 0·95 and 1·05, 10·7 per cent. between 1·05 and 1·10, and 1·7 per cent. over 1·10.

Thus a very small percentage falls outside the limits of 0·90 to 1·10, and it is to be noted that there is practically the same number between 0·90 and 0·95 as there is between 1·05 and 1·10. This is to be noticed also in connection

TABLE I.

Summary of Results obtained with Blood of Healthy People.

Index No. of Individual tested.	No. of Estimations made of this Individual.	Number of Times Opsonic Index was				
		Under 0·90.	Between 0·90–0·95.	Between 0·95–1 05.	Between 1·05–1·10.	Over 1·10.
1	193	1	23	143	23	3
2	77	—	7	62	7	1
3	48	1	1	40	5	—
4	45	—	1	35	7	2
5	43	1	3	34	5	—
6	28	1	5	18	3	1
7	27	—	1	22	3	1
8	21	1	2	14	3	1
9	20	—	2	15	3	—
10	16	—	4	10	2	—
11	11	—	—	10	1	—
12	11	—	3	8	—	—
13	9	—	1	8	—	—
14	7	—	—	7	—	—
15	6	—	1	5	—	—
16	6	—	1	5	—	—
17	5	—	2	3	—	—
18	5	—	—	4	1	—
19	5	—	2	1	2	—
20	5	—	—	4	1	—
21	4	—	—	4	—	—
22	4	—	1	3	—	—
23	4	—	—	3	1	—
24	3	—	—	2	—	1
25	3	—	—	3	—	—
26	3	—	—	3	—	—
27	3	—	1	2	—	—
28	3	—	—	3	—	—
29–32, 2 each -	8	—	2	6	—	—
33–44, 1 „ -	12	—	1	10	1	—
Totals -	635	5	64	488	68	10
Percentage -	—	0·8	10·1	76·7	10·7	1·7

with the two individuals whose index has been measured most frequently.

The low readings may sometimes be explained by overheating the capsule when sealing the end, and some of the high readings by isoagglutination of the red corpuscles, the effect of which will be shown hereafter.

Thus the normal limits, as shown by this table, appear to be 0·90 and 1·10, but it is only fair to point out that, in some cases, the differences are partly obscured when only two controls were used, and each of these divided by the mean of the two counts. Taking this at its very worst, however, and multiplying the difference by two, one obtains figures which still fall within the limits of 0·80 to 1·20, which have from the commencement been taken as being the outside limits of normal sera. To a person, however, who has had long practice with the technique, and who has acquired a familiarity with its dangers and difficulties, an index of 0·8 or 1·2 would be very suspicious, and if, on a second estimation, a second such reading were obtained, he would feel justified in saying that he was dealing with an abnormal serum. It is sometimes of great importance, in connection with the diagnosis of tuberculosis, to note those small constant differences from the normal, as is well illustrated in the following case.

A child was admitted to St. Mary's Hospital with fever and meningeal symptoms, and the physician diagnosed tuberculous meningitis, and asked us investigate her tuberculo-opsonic index with a view to treatment with tuberculin. The first estimation showed an index of 1·19, the next day it was 0·93, twenty-four hours later it was 1·15, and this was followed on successive days by 1·12, 1·13, 1·05, 1·05, 1·19, 1·16. A short time after the last reading was made the child died, and, at the autopsy, a condition of generalised tubercle was found, there being miliary tubercles scattered all over the body, and especially in the meninges. At the time we argued that, as all the readings obtained were within the then accepted limits of error, viz., 0·80 to 1·20, the condition was probably not one of a tuberculous infection. We overlooked the fact, however, that of the first five indices taken, four were over 1·10, and that during the whole time

the index was only once below normal. In Table I. it has been shown that, when dealing with normal sera, one obtains small variations indiscriminately above and below normal, but here was an index practically always above normal, and thus, by failing to recognise the importance of this small constant variation, and by putting down as an error what was an essential difference of the serum, we failed to diagnose a tuberculous infection when it was presented to us in its most acute form.

Since the control has been shown to be sufficiently good, I will now take the method step by step, and point out certain dangers one may meet. The washed corpuscles, bacillary emulsion, and serum having been prepared, one volume of each is taken up into a pipette. Every observer ought to be able to take up with a very fair degree of accuracy equal volumes, so that no error ought to creep in at this stage. The factor, which it is most important to accurately measure, is the bacterial emulsion, and next in importance is the corpuscular suspension. Taking up a double volume of washed corpuscles only reduced the index to ·80, while taking only half a volume increased it to 1·15. Using two volumes of emulsion increased the index to 1·33, while, when half a volume was used, the index was ·68. Two volumes of serum instead of one made almost no difference, and the same was observed when half a volume only was taken up. It is of course impossible in practice to make an error in a volume as large as this, so the error involved in faulty volumes must be very small.

These volumes are now mixed, and this mixing must be thorough, otherwise a low reading will result. In taking up the mixture finally before incubating it, care must be taken to avoid air bubbles, as, if many of these are present, the count obtained is apt to be very irregular, necessitating the counting of a very large number of cells to obtain an accurate result. It was suggested that, if one mixed the corpuscles, emulsion, and serum very violently, the corpuscles might be injured to such an extent that they would not phagocyte so well, so two series of tubes were put up, in one series, the constituents having been mixed very violently through a narrow orifice, and in the other series the contents

were mixed quietly in the usual way. These were incubated for five, ten, and thirty minutes, and it was found that the amount of phagocytosis was almost identical in comparable tubes of the two series, so no injury had been done to the leucocytes from violent mixing.

The next point to which attention must be drawn is the time of incubation. This, of course, must be the same for all the pipettes which are to be compared. The difference in the amount of phagocytosis, when this time is exceeded by a few seconds, is very small however, as can be seen from the following figures, showing the amount of phagocytosis after incubation for varying lengths of time :—

After 3 minutes' incubation each cell averaged 0·46 bacilli.

„	5	„	„	„	„	0·95	„
„	10	„	„	„	„	1·56	„
„	15	„	„	„	„	1·87	„
„	20	„	„	„	„	2·41	„

As a matter of practice, the differences of time in the incubator, even if one is careless, only amount to some 15 or 30 seconds, which, when working with a 15 minutes' incubation time, makes no appreciable difference to the count.

The constituents of the opsonic mixture may now be taken separately to see where fallacies lie.

(1) Washed corpuscles. The questions to be considered in connection with these are :—

(*a*) Does the number of corpuscles used affect the amount of phagocytosis ?

(*b*) What is the effect of agglutination of the washed red corpuscles by the serum employed ?

(*c*) Is the index the same when washed corpuscles are derived from infected or uninfected persons ?

The technique of preparing washed corpuscles has undergone several changes. At first, after being washed, the upper portion, or "leucocytic cream," was removed, and it alone was used. This necessitated the use of a comparatively large quantity of blood to obtain sufficient "cream" to test a large number of sera. Later, after washing with salt solution, the supernatant fluid was drawn off, and the tube inclined at a narrow angle to horizontal, the corpuscles being drawn up

into the pipette from just below the surface. The drawback to this was that, in the first few volumes, one obtained comparatively few corpuscles and a large amount of salt solution. To see if this made any difference, corpuscles were used diluted in various proportions, and the results appear in Table II. It will be seen that, in all cases (except one), there was a higher reading obtained when fewer corpuscles are used. This difference is more marked in the higher dilutions, amounting to 50 per cent. in the fivefold dilution, and slightly more in the sixfold dilution. In twofold dilution the results varied from 10 per cent. to 26 per cent. higher than when the undiluted corpuscles were used with the one exception mentioned above, where probably an error crept in making the difference.

There was here, then, a possible source of quite a considerable error, so to obviate this we now, after pipetting off the supernatant salt solution from the corpuscles, shake them up, and so obtain as nearly as possible an even mixture of white and red corpuscles.

TABLE II.

Showing Results obtained when varying Dilutions of washed Corpuscles were used.

Dilution of Corpuscles used.	Average Number of Organisms per Cell.	Organism used.
Undiluted	1·05	Tubercle.
Diluted 6 times	1·56	,,
Undiluted	1·08	,,
Diluted twice	1·27	,,
Diluted 5 times	1·58	,,
Undiluted	3·46	Staphylococcus.
Diluted 4 times	4·05	,,
Undiluted	2·34	Tubercle.
Diluted 3 times	2·93	,,
Undiluted	4·66	Staphylococcus.
Diluted twice	6·74	,,
Undiluted	3·20	,,
Diluted twice	3·48	,,
Undiluted	3·60	,,
Diluted twice	3·48	,,
Undiluted	1·01	Tubercle.
Diluted twice	1·17	,,
,, ,,	1·10	,,

This method, far from diminishing the number of white

corpuscles in each film, has rather had the opposite effect, as, since its adoption, we have never had any trouble in getting an ample sufficiency of white corpuscles at the end of the film.

(*b*) What effect has agglutination of the washed red corpuscles on the amount of phagocytosis?

It is only comparatively recently that this question has come prominently before our notice, as all the earlier researches on opsonins were done by workers possessing corpuscles which were not agglutinated by any of the human sera used.

Hektoen (*Journal of Infectious Diseases*, June, 1907), following Landsteiner and others, divided individuals into three groups as regards isoagglutination :—

(1) Those whose reds are not agglutinated by any sera, but whose sera agglutinate all those of other groups.

(2) Those whose reds are agglutinated by sera of groups 3 (and 1), and whose sera agglutinate reds of group 3.

(3) Those whose reds are agglutinated by sera of group 2 (and 1), and whose sera agglutinate reds of group 2.

In addition there is a small percentage of sera which do not appear to possess any isoagglutinin.

For practical purposes, as regards the estimation of the opsonic index, we can divide corpuscles into two classes :—

(1) Those which are not agglutinated by any serum. This corresponds with group 1 of the above classification.

(2) Those which are agglutinated by some sera. This includes groups 2 and 3 above.

Hektoen gives the relative proportions of these from an examination of 76 cases as 47 per cent. in Class I., and 53 per cent. in Class II.

From an examination of 138 bloods, I find 46 (or 33 per cent.) in Class I., and 92 (67 per cent.) in Class II.

The relative amount of agglutination which takes place varies with the serum used, for while one serum may agglutinate when diluted 64 times, another may fail to show any clumping in a fourfold dilution, although this was marked with the undiluted serum. The dilution, to which a given serum will agglutinate different red corpuscles, also varies very considerably.

Agglutination of the red corpuscles can be readily seen when an "opsonic mixture," viz., washed corpuscles, bacillary

emulsion, and serum, is prepared. It takes place almost instantaneously, so that, before mixing is complete, a granulation of the mixture may be seen. The red corpuscles in this mixture are, however, too numerous to show the clumping well, so, if one wants to show it most favourably, one takes a 10 per cent. suspension of washed corpuscles, and mixes one volume of it with one volume of serum on a microscope slide. In a few seconds, one can see a granulation of the mixture, and, in one or two minutes, the red corpuscles have run together into masses leaving clear spaces between. In determining the relative agglutinative powers of the different sera, progressive dilutions of each are made on microscope slides, and to one volume of each of those, one volume of the weak suspension of washed corpuscles is added, and, after mixing these, they can either be taken up in a capillary tube as in measuring a bacillary agglutination by Wright's macroscopic method,[1] or better still the clumping can be observed on the slide on which the mixing has taken place. There is usually quite a sharp end point to the reaction when observed with the naked eye.

These isoagglutinins are not completely destroyed by heating to 60° C. for half an hour, but, after such an exposure to heat, the power of a serum is markedly reduced. Thus in two cases, in which a serum had agglutinated certain red corpuscles up to $\frac{1}{64}$ dilution, after heating it would only agglutinate up to an eightfold dilution.

It does not seem to be affected by the salt content of the mixture, as, at any rate, serum will agglutinate up to the same dilution whether the diluent is 1·5 per cent. NaCl or distilled water.

In addition to these groups into which different human sera can be divided, there is another group the serum of which agglutinates its own corpuscles. This appears to be very common in patients in hospital, occurring in about 90 per cent. of those tested.

Those tested were, however, nearly all infected with some micro-organism, and it is conceivable that the poison, which this microbe is pouring into the blood fluids, acts in some way on the red corpuscle, and causes it to be peculiarly susceptible

[1] *Lancet*, July 25, 1903.

to the agglutinin which is present in the serum. It is to be noted, in this connection, that those sera which agglutinate their own red corpuscles, on being drawn off into a blood capsule, when tested later with some of the washed red corpuscles of the same individual which have been drawn directly into citrate solution, do not have any agglutinative action on them, although they are very active towards other corpuscles derived from another individual. The washed corpuscles, before referred to, however, are very susceptible to the agglutinin of other sera being agglutinated by a very large percentage of the sera derived from other individuals.[1]

What the significance of auto-agglutination is is not quite clear, but it seems to be extremely uncommon in healthy people, and, on the contrary, it is very common among our patients both in hospital and in out-patients, occurring in quite 90 per cent. of the patients we treat in hospital, all of whom are affected with some bacterial disease. As regards its practical importance in opsonic work, it would be well to avoid all corpuscles which are agglutinated by the serum of the same person, as they seem to be very liable to agglutination by

[1] This autoagglutination is best observed in very anæmic people when the blood is drawn into an ordinary blood capsule. Here the paucity of red corpuscles shows up the clumping very well, and the whole of the red corps are seen to settle to the bottom of the capsule in masses leaving on the top a milky fluid. This is shown not to be rapid coagulation with contraction of the clot by the fact that later clotting can be seen to occur and the clot contract, entangling all this white matter from the supernatant fluid and squeezing out clear serum. If one also uses this supernatant opaque fluid as serum in an opsonic determination, one finds that there has formed, in the pipette at the end of the period of incubation, a firm clot which renders the experiment useless.

When blood is drawn into a capsule and allowed to clot, if the coagulation time of the individual is lengthened, and especially if the person is anæmic, this autoagglutination of the red corpuscles will show itself by the formation, on the surface of the clot, of a white layer which would seem to be analogous to the buffy coat of horses' blood. This white layer very largely consists of blood platelets, with many lymphocytes and some polynuclear leucocytes.

Shattock (*Jour. Path. and Bact.*, Vol. VI., p. 303, 1900) has shown that in horses' blood where this autoagglutination is very marked, the corpuscles form very long rouleaux, and the same thing happened in connection with human blood in some acute diseases as pneumonia, rheumatism, and erysipelas. In the agglutination of the red corpuscles of one person by the serum of another, however, clumps of corpuscles are formed quite irrespective of rouleaux formation, and rouleaux formation occurs in healthy human blood in vitro, where there is no naked-eye appearance of agglutination, and no rapid sedimentation of the corpuscles. It is possible that it represents a weaker agglutinating action than that described above.

almost all the other sera dealt with.

The important question, in connection with agglutination of the erythrocytes in the corpuscular mixture, is whether or no it affects the degree of phagocytosis. At first sight, it would appear to be a disturbing factor by profoundly altering the even distribution of corpuscles in the pipette, and this is borne out on testing the matter experimentally.

TABLE III.

Table showing Error which may arise through using washed Corpuscles, the Reds of which are agglutinated by some Sera.

Source of Corpuscles.	Organism used.	Sera.					
		A.	B.	C.	D.	E.	F.
Healthy laboratory worker	Tubercle	1·00	1·01	—	—	—	—
Do. do.	,,	1·00	1·98*	—	—	—	—
Do. do.	,,	1·00	0·52	0.98	—	—	—
Do. do.	,,	1·00	2·72*	1·30*	—	—	—
Do. do.	,,	1·47	0·99	0·99	1·28	0·96	1·00
Phthisical patient - -	,,	1·44	1·94*	2·01*	2·32*	2·60*	1·00
Healthy laboratory worker	,,	1·00	0·62	1·03	—	—	—
Phthisical patient - -	,,	1·00	1·07*	1·38*	—	—	—
Do. do. - -	,,	1·00	1·44	—	—	—	—
Do. do. - -	,,	1·00	1·95*	—	—	—	—
Healthy nurse - - -	Staphylococcus.	1·00	2·52*	1·68*	—	—	—
Patient with acute rheumatism.	,,	1·00	1·60*	1·48*	—	—	—
Patient with tuberculous enteritis.	,,	1·00	1·21	1·12	—	—	—
Healthy laboratory worker	,,	1·00	·91	·91	—	—	—
Do. do.	,,	1·00	2·20*	1·77*	—	—	—
Patient with tuberculous hip and secondary infection with staphylococcus.	,,	1·00	2·14*	1·70*	—	—	—
Healthy student - -	,,	1·00	1·74*	1·45*	—	—	—
Healthy laboratory worker	Tubercle	1·00	1·39*	0·98*	1·98*	—	—
Do. do.	,,	1·00	1·10	0·74	1·16	—	—

* Red corpuscles agglutinated.

In Table III. phagocytic experiments were undertaken in which agglutinable and non-agglutinable corpuscles were employed in association with agglutinating and non-agglutinating sera. When non-agglutinable corpuscles were used

concordant results were obtained in duplicate experiments, whether the sera employed were agglutinating or non-agglutinating. Where, on the contrary, agglutinable corpuscles were employed, the results obtained with agglutinating and non-agglutinating sera respectively were discordant, a higher result being recorded where agglutination occurs. The phagocytosis, also, was usually very uneven, so that successive counts of 50 cells differed from each other by very much more than was the case where no agglutination was observed.

In Table III. I have indicated by ordinary type the non-agglutinable corpuscles, that is, those which were not agglutinated by any of the sera used, and by italic the agglutinable corpuscles, *i.e.*, those agglutinated by some of the sera, but not by others. The occurrence of agglutination I have denoted by an asterisk, and it can be seen by reference to the table that, where this has occurred, the opsonic index is higher than in the corresponding observation, where no agglutination has taken place, by amounts varying from 24 per cent. to 220 per cent.; hence, if an observer uses corpuscles of the agglutinable variety it is hardly surprising that he should get some startling results.

(*c*) Apart from agglutination, does the source of the washed corpuscles affect the result?

Wright and Douglas[1] first showed that the phagocytic power of corpuscles from different sources was the same, and this has been confirmed by Bulloch and Atkin[2] and other observers. The following figures also go to support it:—

Source of Corpuscles.[3]	Number of Staphylococci per Cell.
A. Healthy nurse	4·47
B. Child with acute rheumatism	4·38
C. Healthy student	4·52
D. Laboratory workers	4·08
E. „ „	4·00
F. Patient with tuberculous enteritis	3·99
G. Patient with tuberculous and staphylococcal infection of hip	4·02

[1] *Proc. Roy. Soc.*, 1904.
[2] *Proc. Roy. Soc.*, vol. 74, 1905.
[3] Same set of corpuscles as Experiment VI., Table 3

These corpuscles were all prepared at the same time, and under the same conditions, but, if prepared at different times and in different ways, large differences may be observed. The amount of centrifuging appears to have some influence, as, if this is too rapid and prolonged, the corpuscles, although abundant, are clumped, and show relatively less phagocytic power. The freshness of the washed corpuscles also affects their phagocytic power. Thus in general different tubes of washed corpuscles are not interchangeable.

Bulloch and Ledingham[1] have shown that washed corpuscles, taken during the leucocytosis following talianine injection, give a much smaller phagocytic count than normal corpuscles, and I have observed the same with leucocytes from several cases of acute pneumonia, but here again this may be due to the great increase in the number of the leucocytes.

Although the amount of phagocytosis may be different in different tubes of corpuscles, yet it does not seem to affect the opsonic index, whether corpuscles were used from a healthy or an infected person. The following figures bear this out :—

Experiment 1.	Corpuscles A. (Healthy).	Corpuscles B. (Tuberculous Meningitis.)
Serum 1. Tuberculous Meningitis -	0·98	1·12
„ 2. Normal - - -	1·00	1·00

Experiment 2.	Corpuscles from Healthy Person.	Corpuscles from Person with Pulmonary Tubercle.
Serum I. Normal - -	1·00	1·00
„ II. Tuberculous Patient -	0·76	0·78
„ III. „ „ -	1·07	0·99
„ IV. „ „ -	0·79	0·78
„ V. „ „ -	0·66	0·59
„ VI. „ „ -	0·53	0·54
„ VII. „ „ -	0·76	0·61

The second constituent of the opsonic mixture is the bacterial emulsion, and it is largely on the quality of this that the success or otherwise of the estimation depends. First

[1] "Studies in Pathology," from *Univ. of Aberdeen*, 1906.

of all an even suspension of organisms must be obtained, and this is done either by grinding up in a mortar, as in the case of tubercle, or agitating by means of a teat and capillary pipette, as is usually done with other organisms, the resultant emulsion being centrifuged to removed clumps of bacteria. Even when this is obtained some sources of fallacy are to be found. The questions I shall deal with are:—

(1) The strength of salt solution used in making up the emulsion.

(2) The length of time which the organism has been grown in artificial culture.

(3) Agglutinability of the organism.

In dealing with tubercle and some other organisms, notably gonococcus, and the micrococcus neoformans, there some phagocytosis occurs in the absence of serum when the emulsion is made in a weak salt solution. This spontaneous phagocytosis has been noted by Wright and Reid,[1] and they found that it disappeared when salt solution of a strength of 1·5 per cent. was used, hence, in the preparation of emulsions of these organisms, this salt solution is employed.

The length of time which an organism has been grown in artificial culture markedly affects, in some cases, the opsonic index obtained. Some organisms, when freshly isolated, are very little susceptible to phagocytosis, and, in many cases, the serum of the uninfected person exerts very much less opsonic action than that of the infected person. The result of this is an opsonic index which is very high, and may reach as high as 30 or more times normal. When, however, the organism has been carried through many generations on artificial media, it becomes much more easily opsonised by healthy serum, with the result that the opsonic chart steadily comes down, although the patient is doing well. The change, however, is a gradual one, so that the chart will show rises following inoculation in the usual way, and the index still remains a good guide to dosage. That the change is in the organism, and not in the serum, is shown by taking a fresh culture from the patient and comparing the opsonic index to that culture with that to the less recently isolated organism. Using the new organism the opsonic index is much higher. This change is

[1] *Proc. Royal Society*, Series B., Vol. 77, page 211.

especially well seen in some varieties of Bacillus coli and meningococcus.

Some organisms, such as typhoid, Malta fever, meningococcus tubercle, etc., are agglutinated by the serum of an infected patient ; others, such as micrococcus neoformans, are agglutinated by all sera, and this must, by disturbing the homogeneity of the emulsion, disturb the ultimate result. In the case of some organisms, such as tubercle, one can avoid this phenomenon by previously heating the bacillus to 100° C., when it loses its power of being agglutinated. If heated too much, however (to 130° C.), the power of being agglutinated sometimes returns. Most other organisms lose their staining properties when heated to a degree sufficient to destroy their property of being agglutinated, so that this method cannot be generally used but the difficulty can be overcome in some cases, such as typhoid, by using a strain of the organism which has lost its susceptibility to the agglutinins of the serum.

The third and last constituent of the opsonic mixture, namely, the serum, still remains to be dealt with.

The first essential in this connection is that the serum must be free from red corpuscles. At first sight, one might think that the presence of a few more red corpuscles might not make any difference to the degree of phagocytosis, as in the opsonic mixture there is already an abundance of red corpuscles, so that the addition of some more would seem to be of little importance. Then, again, the dilution of the serum has been shown to make very little difference to the amount of phagocytosis, until one gets, at any rate, beyond a dilution of one in four. However, when one comes to take up a number of red corpuscles into the mixture with the serum, one obtains a count much lower than that obtained with clear serum, and this drop is proportionate to the number of red corpuscles which one has taken up. This might be explained by the fact that there is some mechanical obstruction caused by the reds to the phagocytes in their search after the organisms. This action of the red corpuscles may possibly explain the results obtained when the washed corpuscles were used diluted in various proportions, the results of which were given in an earlier portion of the paper. It may also explain the difference met with in using washed corpuscles,

the reds of which are agglutinated by different sera. In this latter case the reds, by their agglutination, are drawn into large clumps without entangling most of the whites, and so the white corpuscles have an opportunity of feeding on the bacteria unobstructed, or only slightly obstructed by the red corpuscles.

Table IV. gives the figures obtained with serum, mixed with red corpuscles, from which it can be seen that enormous variations in the true index are caused by this alone, and a neglect of the precaution of obtaining clear serum may render the observation worthless.

TABLE IV.

Showing Results obtained when Red Corpuscles are taken up with Serum.

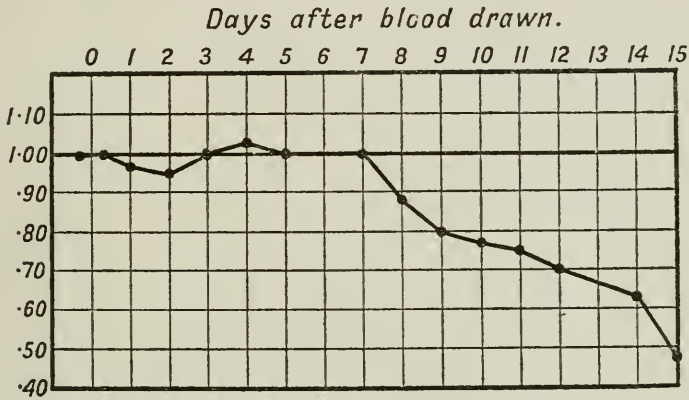
——	No. of Organisms per Cell.	Organism.
Serum clear	3·80	Staphylococcus.
,, with trace of red corpuscles	3·76	,,
,, distinctly red	2·86	,,
,, containing ½ its volume of reds	2·70	,,
,, A. clear	3·64	,,
,, A. with red	3·13	,,
,, B. clear	4·31	,,
,, B. with reds	2·44	,,
,, B. diluted ½ with 85 per cent. NaCl.	3·44	,,
,, clear	1·47	Tubercle.
,, with many red corps	·72	,,
,, clear	2·15	,,
,, with reds = ½ volume	1·03	,,
,, clear	1·80	,,
,, with reds = ¼ volume	1·31	,,
,, ,, ½ ,,	0·64	,,
,, clear	2·28	,,
,, with reds = ⅓ volume	1·74	,,
,, ,, ,, = ⅔ ,,	0·80	,,

The next question in connection with the serum is how long it will retain its full opsonic power. This was tested, both for normal and abnormal serum, and the results obtained are appended in the following table. In connection with the normal blood, two methods were adopted :—

(1) A sample of blood was taken each day, sealed up, and put away in the dark, all the specimens being tested together.

(2) A number of samples were taken at the same time and tested one each day. In dealing with pathological blood only, the second method is applicable, as there is a variation from day to day in its opsonic power.

The following chart is a typical observation of what happens when normal blood is kept at room temperature. For about a week, the index remains at normal then falls steadily till at the end of a fortnight it has been reduced to about ·50 or ·60.



It would appear, however, that it is a long time before the opsonic power disappears from normal blood, as in one case of a serum, 33 days old, the opsonic index was 0·52, while in another case the index, at the end of 39 days, was still 0·65, and after 69 days it was 0·25. The opsonic power had, however, disappeared, on the 84th day. With regard to the serum of infected persons, it might be thought that in cases, in which there was a high opsonic power to commence with, this power would be maintained longer than where the serum, when drawn, had a normal or low opsonic power. This, however, is not what one finds, nor does serum with a low index lose its power of inducing phagocytosis quicker than high or normal serum. The sera of different persons seem to vary very much in their keeping powers, and this without any relation to the index at the time the blood was drawn. Thus, one patient's serum tested on two separate occasions, starting off with indices of 0·94 and 1·17, had almost lost its opsonic power at the end of a week, while another commencing with an index of 0·74 had hardly diminished at all at the end of

TABLE V.

Showing the Effects of keeping healthy Serum at Room Temperature.

Serum used.	Days after Blood drawn.																							Organism used.
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
A.F.	1·00	1·20	1·10	·90	—	·95	—	—	—	—	1·01	·94	1·00	—	—	·63	·78	—	—	—	—	—	—	—	Tubercle.
A.F.	1·00	·98	·95	1·00	1·02	1·00	—	1·00	·89	·80	·78	·75	·70	·75	·63	·46	—	—	—	—	—	—	—	—	,,
	1·03	·95	·97	—	·97	1·00	—	·95	—	·80	·80	—	·73	·75	·62	·42	—	—	—	—	—	—	—	—	Timothy Grass.
L.N.	1·00	—	—	1·01	·79	·90	80	—	·95	—	·79	—	·74	—	—	—	·75	—	—	·74	—	—	·52*	—	Tubercle.
V.C.	·93	·93	·95	·92	—	1·22	—	·90	—	—	—	·98	1·10	—	—	—	1·02†	—	—	—	—	—	—	—	,,
A.F.	1·09	—	—	—	—	—	—	—	·76	—	·82	—	—	—	—	—	—	—	—	—	—	—	—	—	,,
L.N.	0·91	—	—	—	—	—	—	—	·73	—	7 1	—	—	—	—	—	—	—	—	—	—	—	—	—	,,
A.F.	0·98	1·21	·95	—	—	1·01	1·01	·97	·51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	,,

* 33 days old serum = 0·52.

† 32 ,, ,, ,, = 0·68.
39 ,, ,, ,, = 0·65.
69 ,, ,, ,, = 0·25.
84 ,, ,, ,, = 0·04.

TABLE VI.

Showing Effect of keeping Pathological Blood at Room Temperature.

Serum used.	Days after Drawn.															Organism used.
	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	
A.M.	1·20	1·27	1·36	—	1·13	1·20	·75	·62	·64	—	—	—	—	—	—	Tubercle.
W.H.	1·39	1·19	1·09	—	1·23	1·28	·97	·85	·55	—	—	—	—	—	—	,,
J.E.	1·33	1·22	—	—	—	—	—	—	0·30	0·50	0·51	—	—	—	—	,,
A.L.	0·88	—	—	—	—	—	—	—	0·55	—	0·54	—	—	—	—	,,
J.N.	0·97	—	—	—	—	—	—	—	0·56	—	0·68	—	—	—	—	,,
R.D.	0·74	—	—	—	—	—	—	—	0·73	—	0·64	—	—	—	—	,,
A.R.	0·94	—	—	—	—	—	—	—	0·10	—	0·03	—	—	—	—	,,
A.R.	1·17	1·07	—	—	—	0·43	—	0·34	0·33	0·06	—	—	—	—	—	,,
A.R.	0·97	—	—	0·87	0·79	—	0·78	—	—	0·36	—	0·08	—	—	—	,,
J.E.	1·11	1·12	—	—	0·97	—	0·89	—	—	—	—	—	—	0·20	—	,,

10 days. In the same series, other two patients, having indices at the commencement of 1·33 and 0·88 respectively, both fell to above 0·50 on the 8th day.

It does not seem to affect the result whether the serum is kept on the clot, or whether it is separated and kept free from red corpuscles and clot. The temperature, at which it is kept, makes a very great difference, as, if it is kept in an incubator at 37° for about 36 hours, there is a very appreciable drop in the opsonic index, while at 41° there was a drop at the end of 16 hours.

The practical importance of this question is whether or no one may rely upon the opsonic index of a serum taken one or two days after the blood is drawn, as in many cases blood has to be sent to the laboratory by post or otherwise, involving considerable delay. From the above figures, it would seem that results, obtained two or three days after the blood is drawn, are quite trustworthy.

In this connection there arises another question of much practical importance. In the experiments referred to above, the capsules containing the blood were invariably sealed up, but, if one is doing the opsonic index to more than one organism, or if there is some hitch in the first estimation necessitating its repetition, the blood capsule is apt to have lain on the bench open for a considerable time. In such a condition very anomalous results are sometimes obtained. In the following series, all the capsules were filled at the same time by the same person, but the last six were opened, while the first six were sealed up. At the end of six hours, all were tested together to the tubercle bacillus, and it was noted that whereas the first six did not vary more than 7 per cent. from normal, the capsules which had been opened were with one exception all low, one being as low as 0·63.

Opsonic indices of capsules drawn at the same time:—

Six sealed Capsules.	Six open Capsules.
1·00	0·85
0·93	0·79
1·01	0·93
1·02	1·00
0·97	0·63
1·00	0·80

Having now discussed some points in connection with the different factors in connection with the estimation of the opsonic index, we turn to another most important part of the technique, towards which all the other parts are simply stepping stones, namely, the counting of the number of bacteria which have been ingested by the leucocytes. Needless to say, this must be done with great care and conscientiousness, otherwise errors will creep in. In this connection, it should be pointed out that it is a great mistake to have any arbitrary number of leucocytes which one counts, neither counting more nor less whatever the conditions may be. A number of leucocytes, which will give one a good average of a slide with one emulsion, will not furnish a true estimate of a slide with another emulsion which may be uneven or clumpy. If all emulsions were perfect, it would be very easy to say that a certain nnmber of leucocytes per slide would furnish a result differing from the true reading by not more than 10 per cent., but unfortunately in practice emulsions are rarely perfect, and, as life is short, one wants to get at a true estimate of the slide without counting very large numbers of leucocytes such as have been advocated in one or two quarters. It is here that experience will come in and enable a person, who counts intelligently, to obtain a good average with a smaller number of cells than a beginner would require. If a person counts simply mechanically every leucocyte he meets, and fails to bring any intelligence to bear on the subject in hand, however much may have been his experience, and however much care he may have taken to avoid error, if his emulsion is not perfectly even (which is uncommon), he will have to count a very much larger number of cells before he has a trustworthy count of the slide.

The chief rules which we adopt in this laboratory are :—

(1) Avoid all those cells which have ingested obvious clumps of bacteria. This is especially seen in connection with the tubercle bacillus, where even in a good emulsion one often finds one or two cells in a series of slides crammed with bacilli which are all matted together and have obviously been taken up as one clump. To count the bacilli in such a cell would be impossible, and, even if it were possible, it would not be permissible where one wanted to obtain a true average

of the number of bacilli taken up. Counting an opsonic film can be compared with computing the average height of the people by taking the heights of those passing a given point in, say, one hour, but, in such a case it would be hardly permissible to count as an average hour one in which a regiment of Guards went past.

In some specimens of tubercle bacilli, with which we have worked, there is another form of clumping where the bacilli are beautifully discrete, but where they seem to be held together in a mass by some material which does not take the stain. These are quite easy to recognise when they are large, in which case they can often be seen to be attacked by two or three leucocytes, which have taken up, or appear to have taken up, a very great many bacteria, but when these clumps are small, say six or seven bacilli, it is almost impossible to tell whether one is dealing with a clump or with discrete bacilli. These masses of bacteria are very difficult to remove by centrifuging, and the way we have found best to get rid of them is filtration through a double layer of ordinary filter paper.

(2) Avoid parts of the slide where the cells are broken up or where the cells are not well stained. In the present method of making films adopted here, a sharp-edged spreader is used, having its end slightly concave, so that while it presses close on to the slide at each side, yet there is a very narrow interval between the spreader and the slide in the centre, gradually narrowing towards the side. While in the centre of the end of the film leucocytes may be perfect, yet one always finds at the two corners a part where the white corpuscles are badly broken up, so that if one counts 50 or 100 cells in this part, one always obtains a false reading for that slide, and the difference is always in the direction of giving too low an estimate.

It is to be noted here that, in many cases, all the parts of the slide are not stained equally, and one sometimes comes across a patch where the bacilli are very badly stained, or even not stained at all. Thus when one comes across a patch where the count is very small, in comparison with what one has been getting, it is well to have a look for very faintly stained bacteria, or restain the film and count

again. The result is occasionally surprising.

Table VII. shows all the cases between February 18 and May 13 of last year, in which in the ordinary routine of work in the laboratory two or more slides were counted by more than one observer. These dates are taken simply because they correspond with the dates on which one general laboratory day book was commenced and finished. In most of these cases 100 cells were counted, but this rule was never strictly adhered to, more being counted in some, and less in others, according to the regularity of the count; in very few cases, however, were more than 200 cells counted. In the table, each set of numbers represents a separate experiment, so number 1 of each set was taken as unity, and the indices of the others were worked out on this basis. Although, in many cases, the phagocytic counts (number of bacilli per cell) vary considerably between the different workers, yet the ratio of one to another in the same experiment closely agrees in most cases. The letters A. B. and C. do not represent the same individual in the different experiments, but simply denote those out of the nine or ten workers in the laboratory, who, on the occasion in question, happened to count the same two or more slides.

Seventy-six slides were counted by two workers, and of these 76, 24 were counted by three persons. Between the counts of A. and B. only 7 out of 76 differed by more than 10 per cent., between A. and C. 4 out of 24 were over 10 per cent., and between B. and C. only 1 out of 24 was beyond the limit.

In obtaining these figures each observer was quite ignorant of the results obtained by the others until his count was completed, so that the question of "unconscious bias," so dear to the heart of the hostile critic of the method, does not here come into account.

In the earliest papers on opsonins, Wright and Douglas published figures showing that two observers working independently could obtain a very marked degree of agreement in the estimation of the staphylococcal opsonic index. They did not, however, give any figures relating to tubercle estimations, and these being the most important, and it being in relation to tubercle that most objections to the method are

TABLE VII.

Showing the Results obtained by Two or more Observers counting the same Slides.

	Observer A.		Observer B.		Observer C.	
	Phagocyte count.	Opsonic index.	Phagocyte count.	Opsonic index.	Phagocyte count.	Opsonic index.
No. 1 -	2·19	1·00	2·00	1·00	—	—
„ 2 -	2·10	0·96	1·72	0 88	—	—
„ 1 -	2·21	1·00	2.42	1·00	—	—
„ 2 -	2·12	0·96	2·46	1·02	—	—
„ 1 -	1·72	1·00	1·92	1·00	—	—
„ 2 -	1·86	1·08	2·20	1·14	—	—
„ 1 -	1·64	1·00	1·75	1·00	—	—
„ 2 -	2·03	1·20	1·99	1·13	—	—
„ 1 -	1·70	1·00	2·46	1·00	1·99	1·00
„ 2 -	2·58	0·94	2·12	0·85	1·86	0·93
„ 1 -	1·20	1·00	1·10	1·00	—	—
„ 2 -	1·35	1·13	1·17	1·06	—	—
„ 3 -	1·35	1·13	1·23	1·12	—	—
„ 1 -	1·69	1·00	1·86	1 00	1·81	1·00
„ 2 -	1·87	1·10	1·79	0·96	1·81	1·00
„ 1 -	2·51	1·00	2·24	1·00	—	—
„ 2 -	2·46	0·98	2·19	0·98	—	—
„ 1 -	1·58	1·00	1·21	1·00	1·92	1·00
„ 2 -	1·71	1·08	1·28	1·06	1·83	0·96
„ 1 -	1·20	1·00	1·72	1·00	—	—
„ 2 -	1·23	1·02	1·64	0·95	—	—
„ 1 -	2·17	1·00	2·43	1·00	—	—
„ 2 -	2·21	1·02	2·53	1·04	—	—
„ 1 -	1·68	1·00	1·67	1·00	1·75	1·00
„ 2 -	1·52	0·90	1·60	0·95	1·75	1·00
„ 1 -	1·80	1·00	1·83	1·00	—	—
„ 2 -	1·88	1·04	1·77	0·96	—	—
„ 1 -	2·58	1·00	3·04	1·00	—	—
„ 2 -	2·86	1·11	3·44	1·13	—	—
„ 1 -	3·10	1·00	2·88	1·00	—	—
„ 2 -	3·12	1·01	3·13	1·06	—	—
„ 3 -	3·03	0·98	2·82	0·98	—	—
„ 1 -	1·81	1·00	1·79	1·00	—	—
„ 2 -	1 69	0·94	1·71	0·96	—	—
„ 1 -	1·47	1·00	1·35	1·00	—	—
„ 2 -	1·51	1·03	1·25	0·93	—	—

	Observer A.		Observer B.		Observer C.	
	Phagocyte count.	Opsonic index.	Phagocyte count.	Opsonic index.	Phagocyte count.	Opsonic index.
No. 1 -	1·56	1·00	1·58	1·00	—	—
„ 2 -	1·59	1·02	1·70	1·07	—	—
„ 1 -	1·88	1·00	2·16	1·00	—	—
„ 2 -	1·75	0·94	1·75	·80	—	—
„ 1 -	1·35	1·00	1·49	1·00	—	—
„ 2 -	1·39	1·03	1·43	0·96	—	—
„ 1 -	2·44	1·00	2·13	1·00	—	—
„ 2 -	2·25	0·90	1·89	0·89	—	—
„ 1 -	1·59	1·00	1·55	1·00	1·67	1 00
„ 2 -	1·60	1·01	1·64	1·06	1·80	1·07
„ 1 -	2·04	1·00	1·88	1·00	—	—
„ 2 -	1·85	·90	1·76	0·94	—	—
„ 1 -	2·60	1·00	2·32	1·00	—	—
„ 2 -	2·89	1·11	2·40	1 04	—	—
„ 1 -	1·63	1·00	2·30	1·00	—	—
„ 2 -	1·71	1·05	2·16	0·92	—	—
„ 1 -	1·55	1·00	1·60	1·00	—	—
„ 2 -	0·88	0·58	1·03	0·65	—	—
„ 1 -	2·06	1·00	2·29	1·00	2·17	1.00
„ 2 -	2·83	1·39	2·90	1·27	2·61	1·21
„ 3 -	2·03	0 98	2·37	1·03	2·12	0·98
„ 1 -	2·05	1·00	2·49	1·00	—	—
„ 2 -	2·17	1·06	2·37	0·95	—	—
„ 1 -	1·64	1·00	1·77	1·00	—	—
„ 2 -	1·78	1·08	1·90	1·07	—	—
„ 1 -	1·86	1·00	1·94	1·00	—	—
„ 2 -	1·85	0·99	1·77	0·92	—	—
„ 1 -	2·29	1·00	2·51	1·00	2·43	1·00
„ 2 -	1·67	0·73	1·71	0·68	1·88	0·77
„ 1 -	1·69	1·00	1·65	1·00	1·39	1·00
„ 2 -	1·36	0·80	1·00	0·60	0·96	0·69
„ 3 -	1·33	0·78	1·53	0·90	1·44	1·03
„ 4 -	1·47	0·85	1·26	0·75	1·08	0·78
„ 1 -	—	0·85	—	0·84	—	0·90
„ 2 -	—	1·25	—	1·11	—	1·21
„ 3 -	—	1·00	—	1·00	—	1·00
„ 1 -	2·02	1·00	1·87	1·00	1·77	1·00
„ 2 -	2·06	1·02	1·88	1·01	1·73	0·98
„ 1 -	2·26	1·00	2·00	1·00	—	—
„ 2 -	1·67	0·74	1·54	0·77	—	—

raised, I think it well to give the results of six experiments recently made in this laboratory for the express purpose of

ascertaining what degree of accuracy could be obtained. In an earlier part of this paper it has been established that the opsonic index of the healthy individual may be estimated time after time with uniform results, but an equally important question is, whether duplicated experiments with pathological blood will give concordant results. The results of these experiments are set forth in Table VIII., whence it emerges that whereas duplicate estimations of the opsonic index of 26 sera from tuberculous patients were performed (making 52 estimations in all), of these 52 only two differed from their fellows by over 20 per cent., five differed by between 10 per cent. and 20 per cent., and the remainder showed variations of less than 10 per cent.

Fourteen normal sera were used as controls in these experiments, making 28 estimations, and only once did a discrepancy of more than 20 per cent. appear; once the variation lay between 10 and 20 per cent., and the other observations differed from their fellows by less than 10 per cent.

The experiments in Table VIII. are in nowise selected ones. After the films were made all the slides were re-numbered by an independent person, so that the observer was quite in the dark as to which slide he was counting. In addition to the figures in the table one other experiment, the only one of which I have a record, is worthy of mention. Several capsules of blood from a patient with tuberculous cystitis were drawn at the same time. One of these was handed to me; others being sent, without comment, to Dr. Loveday, of Manchester Infirmary, and Dr. Inman, of Brompton Hospital, both of whom had worked for a period of months at St. Mary's. Dr. Inman returned an index of 0·87; Dr. Loveday estimated it at 0·79; and the writer, putting it up in duplicate, obtained results of 0·84 and 0·87, the maximum variation thus being 0·09.

SUMMARY.

(1) The variation in the tuberculo-opsonic index of healthy individuals is very small, and therefore normal serum furnishes a good standard for the comparison of infected persons from day to day.

TABLE VIII.

Showing the Result of Duplicate Observations of the Tuberculo-opsonic Indices.

Expt. No.	Nature of Individual from whom Serum was derived.	1st Observation.	2nd Observation.
I.	Tuberculous arthritis	1·11	1·14
	„ „	0·94	0·94
	Phthisis	1·15	1·14
	Normal	1·02	0·92
	„	0·98	1·08
II.	Tuberculous arthritis	1·12	1·09
	„ glands	0·70	0·82
	„ cystitis	0·88	0·92
	Phthisis	1·37	1·49
	„	1·32	1·19
	„	1·11	1·32
	„	1·52	1·52
	Normal	1·07	0·78
	„	1·14	1·01
III.	Normal	1·00	1·03
	„	1·00	0·97
	Tuberculous glands	0·95	0·98
	„ arthritis	0·98	0·98
	„ glands	0·98	0·94
IV.	Normal	1·01	0·95
	„	1·00	0·97
	„	1·03	1·10
	Tuberculous arthritis	0·84	0·81
	Phthisis	0·85	0·89
	Tuberculous arthritis	0·89	0·97
	„ cystitis	0·78	0·98
V.	Normal	1·02	0·99
	„	0·98	1·01
	Tuberculous cystitis	0·65	0·72
	Phthisis	0·67	0·73
	Tubercular keratitis	0·83	0·83
VI.	Normal	1·04	1·08
	„	1·03	1·10
	„	0·90	0·95
	Tuberculous knee	0·98	1.00
	„ glands	1·11	0·86
	Acute pneumonia	1·00	1·05
	Tuberculous hip	1·24	1·05

(2) With a diminution of the number of washed corpuscles in the opsonic mixture there is an increase in the amount of phagocytosis.

(3) Agglutination of the washed red corpuscles increases the amount of phagocytosis.

(4) The tuberculo-opsonic index is the same whether

washed corpuscles are used from a healthy or tuberculous individual.

(5) If red corpuscles are taken up with serum the amount of phagocytosis is reduced.

(6) Serum sealed up in a capsule at room temperature retains its full power, in the case of healthy blood, for at least a week, and, in the case of pathological blood, for a day or two less.

(7) Blood capsules left widely open for several hours give very untrustworthy readings.

(8) Two practised observers can count the same slides, and obtain results in almost all cases within 10 per cent.

(9) Duplicate estimations of the tuberculo-opsonic index of tuberculous patients can be performed, the results differing from each other by less than 20 per cent., except in rare instances (2 in 52).

In conclusion I beg to thank Sir Almroth Wright for permission to use his laboratory records, also all my colleagues in the Inoculation Department at St. Mary's, who of necessity did much of the work which appears in this paper, also certain American pupils who checked my counts of many of the slides, especially Dr. Matson of Oregon, Dr. Matthews of Denver, and Dr. Woglom of Brooklyn.

OBSERVATIONS ON THE OPSONIC INDEX IN INFANTS.

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The object of the present communication is to record a series of results, which have been obtained during the past three years, by estimating the opsonic indices in a large number of infants under one year old. The majority of these babies had been admitted to the Hospital for Sick Children, Great Ormond Street, for operations for cleft-palate or hare-lip or both, and had, therefore, of necessity been artificially fed. A number of other cases have been dealt with: new-born babies, infants from one to four weeks (maternity cases), and children of various ages admitted to hospital for congenital hernia, hydrocele, circumcisions, etc. These were all healthy breast-fed children.

My fellow-worker, Dr. J. Freeman, and myself made observations on the opsonic indices of the sera of parturient mothers and their new-born babies. The samples of the newly-born infants were taken from the umbilical cord, and the greatest care was exercised so as not to get any contamination with antiseptic. Table 1 gives the average opsonic indices of the bloods of 11 mothers and 17 babies to four different microbes. The indices of individual samples showed very small variations.

TABLE 1.

——	Tubercle.	Staphylococcus.	Streptococcus.	B. Coli.
Mothers - -	1·00	0·76	0·57	1·15
New-born babies -	0·80	0·90	0·83	0·44

Next we took healthy babies in the maternity district of this hospital, and "pooled" the sera of children aged one, two, and four weeks respectively. Table 2 gives these results. In both Table 1 and Table 2 the normal taken was a "pool" of sera of healthy men.

TABLE 2.

Age.	Tubercle.	Staphylococcus.	Streptococcus.	B. Coli.
One week -	0·92	1·08	0·67	—
Two weeks - -	0·48	0·68	0·80	0·54
Four weeks -	0·30	0·25	0·38	0·32

Table 3 gives the opsonic indices at each month from birth to one year. These results record the opsonic indices of individual samples, and not the averages of a number of observations as in Table 1, or readings obtained by pooling sera as in Table 2.

TABLE 3.

Age.	Tubercle.	Staphylococcus.	Streptococcus.	Other Microbes.
	Lowest. Highest.	Lowest. Highest.	Lowest. Highest.	Lowest. Highest.
Under one month	0·20 1·48 (9)	0·06 0·87 (12)	0·44 1·27 (7)	
1–2 months -	0·07 1·15 (4)	0·14 1·00 (12)	0·30 1·16 (8)	Coli 0·80. Gonococcus 0·25.
2–3 „ -	0·01 0·73 (9)	0·07 0·99 (13)	0·08 1·16 (9)	
3–4 „ -	0·40 0·74 (3)	0·14 1·12 (8)	0·67 1·13 (4)	
4–5 „ -	0·28 0·82 (3)	0·52 0·88 (5)	0·12 0·85 (4)	
5–6 „ -	0·89 1·11 (4)	0·06 1·09 (5)	0·10 1·15 (4)	0·53 *Gonococcus* 0·70. Coli 0·56.
6–7 „ -	0·74 0·74 (1)	0·41 1·00 (6)	— —	
7–8 „ -	0·15 0·82 (2)	0·21 0·61 (2)	0·54 0·67 (2)	
8–9 „ -	0·98 1·07 (2)	0·44 1·02 (3)	0·50 1·10 (2)	
9–10 „ -	0·90 — (1)	0·42 1·58 (5)	0·70 1·34 (3)	
10–11 „ -	1·01 1·01 (1)	0·88 1·07 (2)	0·8 0·95 (2)	
11–12 „ -	0·73 0·73 (1)	0·74 1·10 (4)	0·79 0·96 (2)	

This table includes all the children, both breast-fed and artificially-fed, and the results are arranged to show the highest and lowest readings obtained at each age.

The small numbers in brackets indicate the number of observations which have been recorded at the particular age against the organism in question.

It will be seen from these results that the opsonic index in babies is subject to great fluctuations from time to time, and the following cases are quoted to show the great alterations which may occur.

Case 1.—C. L., male baby, admitted for operation on a cleft-palate and hare-lip. Indices to staphylococcus at ages—

7 weeks	0·80
8 „	0·14
9 „	0·07
10 „	0·22
12 „	0·09
13 „	0·14

Patient discharged and re-admitted to hospital at age of—

26 weeks	0·79	Before and after inoculation with 50 M. staphylococci.
And on admittance 24 hours afterwards	1·15	
30 weeks	1·23	

Case 2.—E. S., female baby, 3 months old, admitted for same reasons as Case 1. Indices taken to :—

	Tubercle.	Staphylococcus.	Streptococcus.
1	0·56	0·85	0·70
2	0·04	—	0·08
3	0·01	0·45	—
4	0·01	0·33	—
5	0·67	0·81	0·60

The first four observations were made on five consecutive days, and between the fourth and fifth a small inoculation was given consisting of tuberculin ($\frac{1}{36000}$th mgm.), staphylococci (25 million), and streptococci (12 million).

Case 3.—W. B., male, admitted for cleft-palate and hare-lip.

	Staphylococcus.	Streptococcus.	
2 months	0·30	0·33	Before and after
	1·60	0·60	inoculation.
8 months	0·44	—	
23 „	0·73	0·70	

Cases 1 and 2 show a striking fall in the opsonic index occurring within 48 hours of their admission to hospital, and all three cases demonstrate the rise in resistance after inoculation. This experiment has been repeated on several other occasions, and each time a rise has been found when the serum has been examined during the 24 hours subsequent to inoculation, and the same has been found in cases of suppuration where the patient apparently re-acts well to the auto-inoculation from the patient's septic surfaces.

From the foregoing results I think one may draw the following conclusions :—

(1) A low opsonic index is not diagnostic in children under one year old.

(2) In infants a low opsonic index is not inconsistent with health, and the child may be thriving well with a declining index.[1]

(3) Where the opsonic index is low this will rise in response to the stimulus of an inoculation with a bacterial vaccine.

(4) Inspection of the results embodied in Table 3 would appear to show that the healthy breast-fed infant possesses no advantages over the healthy artificially-fed child.

(5) The anti-bacterial defence in children cannot depend upon the opsonic content of the serum.

[1] While in healthy children a low index may have no significance, it would appear to be of the gravest prognostic importance in infected adults. In two cases of septicæmia, indices as low as, and even lower than, those in Table 3, were found immediately before death. In one case the index to staphylococcus, with which the patient was infected, declined from 0·83 to zero, and in the other, a tretragenus infection, the resistance was phenomenally low to tubercle, staphylococcus, and gonococcus.

NOTE ON THE EXPERIMENTAL ERROR IN THE METHOD OF DETERMINING THE TUBERCULO-OPSONIC INDEX OF THE BLOOD.

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ATTEMPTS, emanating from different quarters, have recently been made to impugn the accuracy of the method of determining the opsonic index of the blood.

No method is absolutely free from error, and the error must vary with the worker. This is especially true where, as in the present instance, the technique is complicated, and and every step is a possible pitfall. The error may be very great in the case of a worker who has but imperfectly mastered the details of the procedure for determining the opsonic index. When once the method has been even moderately well mastered, the experimental error will be so slight as to be practically of no importance.

In this connection the table below may be of interest.

It was compiled at a time when the writer had still to learn many of the minor and finer details, which make for greater uniformity and perfection, and was shown, at a meeting of the Dublin Biological Club, in March 1906, in the form of a lantern slide with the object of demonstrating the comparatively slight experimental error in the method.

At that period, the writer was in the habit of doing a number of blood counts, usually from 15 to 30, regularly, twice a week. The serums, on each day, were numbered and set in order, care being taken to have a known normal serum, or the pooled serum from three or four normal individuals included with each batch to be incubated. The resulting films were stained, taken home, and counted during the later hours of the same evening and the early ones of the next morning. As a matter of routine, the bacilli in 50 cells were counted. *The slides were always indiscriminately examined without any reference to the numbered list containing the names of the individuals from whom the bloods were taken.* As a matter of fact, this list was usually left behind in the laboratory. The mean number of bacilli found in the slides, made from

the normal serums, or in the slides, made from the pooled serums, was taken as the normal index, and calculations were made accordingly.

It can be readily seen, from the table below, that the variations between the counts of the different normals employed on the same day, and incubated with different batches, are very slight (from 4 to 8 per cent.). Similarly the variations in the different slides, representing the pooled serum used with the various batches, ran from 6 to 13 per cent.

Thus it is obvious that, even at a period when the writer's technique and general methods required considerable improvement, the maximal experimental error ranged from 4 to 13 per cent. A similar table, prepared from recent figures, would reduce this error by almost one half.

—	*Normals.*	Bacilli in 50 Corpuscles.	Index as compared with *mean.*	Maximum Error (represented by difference between highest and lowest).
21 bloods done on 21—ii—06.	6. H.S.	128	·94	·08
	16. A.C.	139	1·02	
	20. H.S.	138	1·02	
13 bloods done on 24—ii—06.	1. W.B.	120	1·02	·04
	8. W.F.	115	·98	
24 bloods done on 3—iii—06.	5. W.B.	202	·96	·07
	16. W.F.	217	1·03	
	22. C.O'M.	211	1·00	
22 bloods done on 7—iii—96.	3. C.O'M.	159	1·03	·08
	14. A.C.	154	1·00	
	21. W.F.	146	·95	
14 bloods done on 10—ii—06.	6 Pool (3).	227	·97	·06
	13 „	241	1·03	
15 bloods done on 14—ii—06.	6 Pool (3).	154	1·04	·09
	13 „	141	·95	
29 bloods done on 17—ii—06.	1 Pool (3).	Spoiled.	—	·13
	9 „	133	1·00	
	17 „	124	·93	
	27 „	140	1·06	
19 bloods done on 28—ii—06.	3 Pool (3).	Spoiled.	—	·09
	12 „	138	1·04	
	19 „	126	·95	

STATISTICAL CONSIDERATIONS RELATIVE TO THE OPSONIC INDEX.

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In discussing the problems connected with the treatment of disease by the employment of bacterial vaccines, it is important to separate questions which, although radically distinct, tend to be confused.

Thus, the question as to how far the "opsonic index" is a trustworthy guide in the diagnosis and treatment of disease is not to be confounded with the discussion of therapeutic inoculations as curative or prophylactic methods; data which throw light upon the former subject have little bearing upon the latter.

In the present note I am occupied with the former problem, in so far as it concerns the statistician, and I desire to preface my remarks by some words of apology and explanation.

In the first place, as will be seen, I have expressed such conclusions as seem justifiable in a very hesitating manner, which may be irritating to practical men. The excuse is that we have, in the London Hospital Statistical Department, a considerable mass of data from various sources which still awaits analysis. My colleague, Dr. Douglas White, and I hope to publish a full account of the matter when our investigation is complete. At the present time, it is perhaps worth while to indicate certain of the difficulties which have to be faced in an inquiry of this sort.

I must further apologise to any statistical reader for the evident vagueness of my description. It would, I think, be affectation to pretend that a technical description of statistical work is likely to be intelligible to the majority of medical readers.

By the kindness of Dr. Bulloch and Dr. Western, I have been able to examine the phagocytic counts obtained in the inoculation department and used for opsonic determinations

These are based on the average of 75 cells, and relate, as does all my material, to tuberculosis. The first question that arises is how far can a value, based upon a sample comprising 75 cells, be trusted to give a fair measure of the whole "population" of cells?

It is clear, from common-sense principles, that *at least* two points must be of importance in forming such an opinion; the number of cells counted, and their variability in respect of apparent phagocytosis. The larger the number of cells counted and the less the individual differences in the quota of bacilli per cell, the more accurate will be the mean value of such a count as a measure of phagocytic power.

At first sight, it would seem to be easy to solve the problem. The statistician can determine the mean number of the bacilli in the "control" count, the mean number in a "pathological" count, and compare the difference of these means with the "probable error" of such difference. In this connection, the "term probable error" is to be understood in the following sense. If the mean of a sample is 4, and its "probable error" $\pm$ 1, then the chances are even that a second sample of the same material will give us a mean within the limits of 5 on the one side and 3 on the other. If another sample gives a mean outside these limits, we can state, in arithmetical terms, the likelihood of its being a chance variation; naturally, the greater the deviation the less likely is it that the difference is a mere accident. Thus the odds are 40 to 1 against a positive deviation as great as, or greater than three times the "probable error" of the first mean being found in a second sample of the same material. Hence, if the "pathological" count gives a deviation of this order, we may assume that it is drawn from a "population" differing, significantly in respect of phagocytic power, from that which was the source of the first sample.

This would therefore appear to give us a simple criterion of significance. The "probable error" of each mean and the "probable error" of the difference between any pair of means can be readily determined. In fact, I have applied the test in 169 cases (*i.e.*, 169 sets of 75).

Comparing the differences of "control" and "pathological" means with their "probable errors," it appeared that, while

"opsonic indices," within the limits 0·8 and 1·2, were not in general significant, beyond these values, the results were perfectly definite.

It might therefore appear that, adopting the somewhat generous limit of ± three times the "probable error" as a standard, the statistical margin of error could hardly be greater than 20 per cent. either way. Unfortunately, a suspicion I was led to entertain from an examination of the 75 counts has proved to be well founded. It seemed, even in the short counts, that the distribution of values above the mean was not symmetrical, that, in any distribution, values below the mean did not occur with the same frequency as values greater than the mean. Of course, this point could not be properly tested until much larger numbers were available, and several workers kindly supplied me with counts of from 750 to 1,110 cells. Some of these counts were then tested by the ordinary methods of curve fitting[1] with the result that the distributions were found to be markedly asymmetrical, or "skew." In one case, which has been completely worked out, the distribution was most accurately reproduced by a skew curve of Pearson's first type, the graphical form being somewhat as in the diagram (Fig. 1).

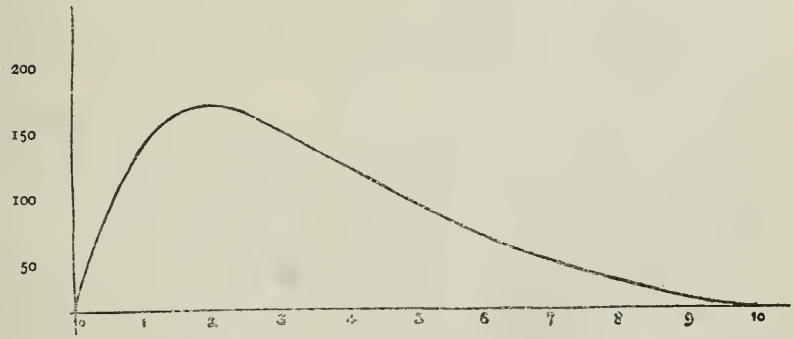

Fig. 1.—*Sketch of a frequency distribution of Phagocytes, showing marked skewness.*

The importance of this discovery for our purpose is great. The whole validity of the ordinary "probable error" method depends upon the assumption that positive and negative deviations are equally frequent, and are distributed symmetrically on either side of the mean value. We construct, as it were, on

the basis of each mean value, a symmetrical curve, and assume significant difference, if these curves do not overlap (Fig. 2).

But, if this assumption fails, then what appear to be significant differences may not really be so, and conversely. The real distributions may overlap as in the two dotted curves (Fig. 2).

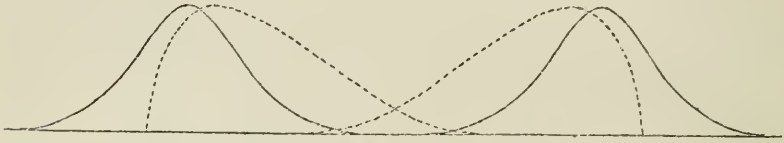

Fig. 2.—*Showing the difference between symmetrical and skew distributions.*

We have, in fact, a form of distribution in which positive "errors" are not equally frequent with negative "errors," and can only obtain a measure of accuracy when we know the exact form of the skew distribution.

The analysis of my material is not yet sufficiently advanced to permit of definite statements being made, but certain indications are of theoretical and, perhaps, practical interest.

Although all the constants, at present calculated, point to Types I. and III. of Pearson's skew curves, the values suggest that with thick emulsions the asymmetry is diminished. In other words, the greater the mean value, the less marked is the skewness.

I am in hopes that this indication, if confirmed by further analysis, will be of practical use. It might be supposed that increasing the thickness of the emulsion would merely shift the curve bodily along its axis, and not change its form. There are reasons, however, why this should not be the case.

In a study of the age incidence of Enteric Fever, Pearson and Filon [2] show that a rise in the modal value of a character * diminishes the skewness, under certain conditions. Evidently, the modal value rises with the thickness of the emulsion.

Again, Sir Almroth Wright has pointed out to me that we have to consider whether all the cells have equal opportunities

* The modal value is the value most frequently occurring in the sample, *e.g.*, if in a sample 30 cells have 3 bacilli per cell, 15 have 2 per cell, and 20 have 1 per cell, the modal value is 3.

of ingesting bacilli, before we can discuss their respective phagocytic powers. It is, I think, reasonable to believe that the thicker the emulsion (provided it is free from clumps), the more closely do we approach this equalisation of chances.

It is therefore quite probable that, by raising the mean, we shall diminish the skewness of our distributions. The practical advantage of so doing would be that the ordinary "probable error" method would once again become a reasonable test of trustworthiness from the statistical point of view.

What I desire to emphasise at present is the fact that, until this question is definitely settled, reasoning, based upon apparent differences in mean values, even when considerable, is hardly justifiable.

In the present state of the question, I think we are entitled to say :—

(1) There is no valid evidence that the limits of error do not exceed 20 per cent. of the mean value.

(2) The skewness of the distributions, so far examined, is so great that, in the case of low emulsions, errors in excess are more frequent than "errors" in defect of the mean.

(3) There is reason to hope (but no proof) that with high emulsions the variation may become more symmetrical.

The practical suggestions are, I think, (*a*) high indices should be more closely scrutinised than low values ; (*b*) it is better to work with tolerably thick emulsions, giving an average for the normal serum of not less than 3 bacilli per cell.

The point I am most desirous of making clear is the *extreme* skewness of the distributions. If this is grasped, common-sense reasoning makes it clear why we cannot assert that positive and negative deviations are equally likely.

In the absence of better evidence, it is evident that means determined on small counts, and indices calculated from them, should be employed with great caution.

It is most desirable that, in published results, the actual phagocytic counts, from which the indices were calculated, should be given.

I may add that the characters of these distributions are so well marked that it is hardly reasonable to suppose that the variation observed is a mere result of experimental errors.

In practice, even were this the case, it is to be remembered that the figures I have examined are obtained from highly skilled workers, and conclusions, based upon them, must yield a minimum error from the general standpoint.

I should like, in conclusion, to point out that the term significance, as used by the statistician, has a somewhat specialised meaning. Thus, as I have already remarked, the odds against a deviation as great as three times the "probable error" of the first constant being observed in a second sample of the same material are about 40 to 1. That is to say, the chances are about 20 to 1 that the second value will be within the limits of ± three times the "probable error." For example, supposing we were able to calculate the "probable error" of a given opsonic index, and found that the index 1·3 had a "probable error" of ± 0·1. Then, by referring to a table,* we should find:—

The chances are 20 to 1 that the "real" value is not greater than 1·6 or less than 1·0.

The chances are 4·5 to 1 that the "real value" is not greater than 1·5 or less than 1·1.

The chances are even that the "real" value is between 1·4 and 1·2. Evidently, each must judge for himself what limit of probability to take as a standard, but it is well to remember that such standard is, in some measure, arbitrary.

* *e.g.*, the table in "Czuber's Wahrscheinlichkeitsrechnung, etc.," 1902, p. 232.

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[1] Pearson, K.: "On Skew Variation," *Phil. Trans. A.*, vol. 186, pp. 343–414.

[2] Pearson, K., and Filon, L. N. C.: "On the Probable Errors of Frequency Constants, and on the Influence of Random Selection on Variation and Correlation," *Phil. Trans. A.*, vol. 191, p. 279.

TREATMENT BY BACTERIAL VACCINES.

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The term "bacterial vaccine" is advisedly used to distinguish it from "serum."

A bacterial vaccine is a sterilised, standardised emulsion of the infecting micro-organism. It is made by scraping the film of a recent agar culture into one per cent. salt solution, sterilising at 60° C., and subsequently standardising to a given number of micro-organisms per cubic centimetre.

A serum is the blood serum of an animal which has had its resistance presumably fortified by repeated injections of minimal doses of the infecting organism.

The action of a bacterial vaccine, as evidenced by the opsonic index, is, if given in a proper minimal dose, to produce first a slight lowering of the opsonic index, followed by a rise higher than the starting line. Some action takes place between the tissues and the dead micro-organism (vaccine) whereby antibacterial substances, amongst which are Wright's estimable opsonins, are liberated into the blood stream. Considering the minuteness of the dose and the magnitude of the reaction, it would appear that the interchange between the dead bacteria and the tissues must be almost comparable with the prolonged action of enzymes, or the action of certain salts of platinum.

A serum, on the other hand, contains manufactured products—antitoxins. Its action is probably—quâ serum—purely a neutralising one—so much antitoxin will neutralise so much toxin.

Any further action is probably due to the presence of dead micro-organisms in the serum, which then behave practically as a feeble bacterial vaccine.

This being so, it is easy to understand how the sera have failed, except in diphtheria, a disease where the growth of the micro-organism is extremely limited, and whose destructive power lies in the toxins which are poured into the circulation.

In the majority of infections, it is necessary to prepare a vaccine from the cultures of the particular micro-organism. It is not wise to have a standard vaccine, excepting in the case of tuberculin; and it is doubtful whether it will not be found necessary to recognise and treat types of tuberculosis accordingly.

Investigations on coli and the pneumococci have shown conclusively that these micro-organisms vary in each host; and that probably there are many species which exhibit the same microscopical and cultural appearances.

This goes far to explain the failures in the attempt to cure with anti-pneumococcal sera.

It is not strictly accurate to say that bacterial inoculation is a new treatment. The pioneers of bacterial inoculation introduced the use of a modified small-pox; Jenner followed with his cow-pox; Pasteur introduced his attenuated virus for hydrophobia, and Koch his tuberculin. With the success of the diphtheria antitoxin, we followed blindly the serum school, the fallacies of which were ably exposed by Wright in an address to the Chelsea Medical Society.[1]

I have thought it necessary to go over all this old ground, because there are still many who have yet failed to grasp the fundamental differences between a serum and a bacterial vaccine.

Let us, at this point, consider briefly what the process of immunisation means. An individual is immune to the invasion of a certain infective micro-organism, because his blood contains a sufficient quantity of antibacterial substances to kill off the invader, and so prevent it obtaining a footing for further ingress and colonisation.

If a footing is obtained, and colonisation has begun, the destruction of a portion of the invading army will produce a strengthening of the defending force. This phenomenon is known as auto-inoculation, and is best instanced in the pneumonic crisis, or the rise of protection after a crop of boils. In some infections the protection afforded is lasting, as in small-pox, in others very transient, as in tuberculosis. Some infections again produce tissue destruction, or a chronic

[1] *Clinical Journal*, May 16, 1906.

inflammation, resulting in a cutting off, or a lessening to the infected area, as in tuberculous lesions.

Various factors present themselves to us as militating for or against a rise of the immunising power and the consequent destruction of the invading host. It is not difficult to understand therefore that, when the invasion is of a type which proceeds without tissue destruction, or without unduly paralysing the functions of the nervous system, self-immunisation is likely to take place, owing to the death of a certain number of the infecting micro-organisms, and their immediate effects as inoculating agents. It is, therefore, reasonable to suppose that the introduction of a favourable number of dead micro-organisms, artificially as a bacterial vaccine, in the case of a general infection, may just turn the scale, and produce that immediate reinforcement of the defending forces which, at the moment, is so urgently needed. Nay more, it may turn a local defeat into a route, as each invader destroyed becomes a potential defender. Stripped of scientific phraseology, and viewed as a quasi-military problem, the crisis in pneumonia and in influenza becomes dimly intelligible. Are these assumptions borne out by facts? Admitting that the opsonic curve is a fairly accurate measure of the immunising power, observation of the index alone gives us a substantial basis for our argument. MacDonald [1] has shown that the opsonic curve of the pneumococcus rises rapidly just before a crisis, and takes some days to fall to normal. He further succeeded, after inducing a pneumonia in rabbits, in producing an artificial crisis and recovery by the introduction of a bacterial vaccine. He found it necessary to employ a vaccine made from the same strain as the infection. My own experience, clinically, has entirely corroborated this experiment, and, during the last two years, four cases, which failed to immunise themselves, responded at once to the introduction of bacterial vaccine made from cultures of the individual's own pneumococcus. In America, last year, a series of successful inoculations for pneumonia was recorded, and I am bound to believe that, before long, this treatment will be recognised as sure for pneumonia, as the antitoxin is for diphtheria.

Amongst general infections, without tissue destruction at

[1] Trans. Pathological Society, 1906.

first, I must mention the streptococcal infections; Douglas, Wright's fellow worker, successfully inoculated a severe case of septic endocarditis in April 1906; and, in 1907, I had the good fortune to be able to work out the opsonic curve in a child similarly infected, who had recurrent attacks of fever, with endocardial disturbance, every three or four weeks.

It was shown in the latter case that the opsonic index fell to about ·5 or lower just before an attack; that after four or five days' fever the curve rose; and that the attack died out when the figure reached 1·2 and over. The index remained high for a week or so, and then gradually dropped until the immunising power became so low that a fresh colonisation, evidenced by sore throat and cardiac disturbance with fever, occurred. The effect of inoculation of a special vaccine, when the index had dropped to its lowest, and the clinical manifestations were beginning, was to cause a rapid rise of the opsonic curve, and a complete abortion of the attack in 12 hours. This was repeated on several occasions to the obvious benefit of the patient and the gradual discomfiture of the streptococcus. A case of this recurrent type, closely investigated, throws, I think, a great deal of light upon the clinical problem of recurrent sore throat with the possible sequel of endocardial infection.

Since reading this paper a case of severe erysipelas of the face has occurred. The exhibition of a bacterial vaccine made from the infecting organism on the sixth day of the disease, when the temperature was 105·4, pulse 140, respiration 45, and the patient was in imminent peril, resulted in a recovery by crisis. The temperature dropped to 98·8, 14 hours after the inoculation.

From the foregoing remarks, it will be gathered that a general blood infection by no means contraindicates, but rather favours, the use of a bacterial vaccine, for, in both the pneumococcal and the streptococcal infections, the blood is teeming with these micro-organisms. Why the introduction of a relatively small number of dead micro-organisms into the tissues should evoke so extraordinary a response in the immunising power, I cannot attempt to explain. All I would say is, that the introduction of an appropriate bacterial vaccine into the circulation tends to produce a negative phase,

but the opposite occurs if injected into the tissues; and, further, the degree of benefit is more or less proportional to the slowness with which the interaction between the tissues and the vaccine takes place. Rest after inoculation is necessary for a good opsonic upward flow; active exercise on the other hand produces a sharp negative phase; and exercise tends to promote rapid absorption into the circulation of fluids introduced into the tissues.

It has fallen to my lot to treat with bacteriological vaccines several cases, which evidenced general infection, together with local destructions of tissue; and, before proceeding to discuss these, it is profitable to consider the opportunities of the immunising process in local lesions. It is obvious that, in these latter situations, the circulation has become impaired both by central destruction of tissue, and by peripheral infiltration, and subsequent fibrosis. Assuming that the opsonic content is high, the lesion will present an area, as Wright has termed it, of low bacteriotropic pressure, chiefly because the blood is unable to get to it in sufficient amount to flood it with immunising materials. It is for this reason that an empyema, when properly drained, rapidly sterilises its walls and heals; and we are not surprised to find that the original content is low in opsonic value, but, directly the pressure is relieved, and the blood serum can flow through the walls, that the opsonic value of the succeeding discharges rapidly rises.

I have tried on several occasions to treat stubborn abscesses and sinuses, connected with bone lesions in the pelvic region, with the appropriate bacterial vaccines. In one case the bladder was also infected with the same micro-organism as the tissue lesion, namely, the coli bacillus. Three inoculations were sufficient to cure the cystitis; but the tissue lesion did not heal, until absolutely perfect drainage, combined with a free resection of the fibrous tissue round the sinus, had been effected. That the bacterial vaccine was the determining factor in promoting a final result, after the surgeon had done his part, is shown by the fact that the latter had several times operated before, with the same subsequent unsatisfactory condition. During the final healing process, the opsonic content was never below 2·0. The bladder healed at once

because here was a local condition favouring the free admission of opsonins.

Another mixed case was that of an old gentleman of 75, who, at the beginning of 1906, suddenly developed an acute infection, which was clinically presumed to be influenza.

Cystitis soon occurred, and a bacteriological examination showed that the coli bacillus was the offender. His expectoration was crowded with the coli bacillus, and his vomit contained the same micro-organism. His son, a medical man, sanctioned the exhibition of a coli vaccine made from the cultures. Repeated doses were given, and, as his opsonic curve rose, the general infection abated. For months, however, he passed at times, per urethram, blood and prostatic débris; rectal examination showed an enlarged and tender prostate. His general immunity was such, however, that, although his local infection was not cured, the coli could not reinfect him. I do not believe that he will ever locally lose the coli, unless his prostate is removed, to which course he will not consent.

I think that a study of opsonins and bacterial inoculations teaches us very clearly this fact, I mean those of us who are surgeons, that in certain conditions, particularly in tubercle, it is a wise thing to ascertain what the opsonic content is before operating, and, if it is low, and, if time will permit, to artificially raise it by inoculation before operating, and not after, if we wish to obtain rapid healing.

Nothing shows the wisdom of this proceeding more clearly than in the case of tuberculous glands in the neck. No amount of inoculation will get rid of fibrous glands, much less glands with a larger centre of caseation. On the other hand, nothing is surgically so annoying as the infection of the wound, when operating, by the breaking down of a gland and the subsequent formation of a troublesome sinus. Nothing, however, can exceed the satisfaction of the surgeon if this happens when he knows that, in consequence of a high opsonic index, previously produced by a deliberately planned series of inoculations, he will in all probability get primary healing. I do not know if this is generally practised yet, but I have reason to believe, from my own limited experience, that it should be. I know my results are very different now from what they used to be.

I believe Wright has introduced the practice in the surgical wards of St. Mary's of estimating the coli index in certain cases of appendicitis, where a coli infection is suspected, with a view of lessening the risk of subsequent infection of the wound through stray coli.

I think that these few remarks have indicated the use of bacterial vaccines to the surgeon. We may say, with truth, that the antibacterial substances produced, by the bacterial vaccine, are a better friend to him than the irritating, cell-destroying external antiseptic. There is also some truth, in fact, all truth, in the statement a man makes in the outpatient department, when he tells the sceptical student that he has a good flesh for healing.

Rest a Factor.—I have mentioned before that rest is an important factor in the treatment of infective processes, whether accompanied by bacterial inoculation or not. I may illustrate this by the usual surgical procedure in the treatment of tuberculous disease of the hip joint. Rest is all important. Movement brings about liberation of auto-inoculations, over-doses, negative phases, flaring of the infection, and so on.

Rest, when it abolishes these untoward symptoms, also brings the opsonic index to what might be termed the habitual low-tide mark of the patient. Bacterial inoculation, suitably carried out, can so regulate the index as to keep it constantly above the normal line. The benefit is great to the joint, as well as to the general well-being.

Two cases of morbus coxæ which, under the usual regime, were ear-marked as unsatisfactory with a bad prognosis, have recently cleared up without a single set-back ; and it is interesting to note that, whereas, six months ago, it was difficult to keep the index at high-water mark, at the present time it is always just above normal, even after discontinuing the inoculations for a considerable interval. Wright[1] has pointed out that the index may be used in the early stages of getting about as an absolute diagnostic indication as to whether the lesion is absolutely cured. If not, fluctuations, owing to auto-inoculation, will soon appear.

I have mentioned rest, free circulation, and drainage as

[1] *Lancet*, Nov. 2, 1907.

essential factors in the immunising process by bacterial vaccines.

Let us consider tuberculous invasion of the lung as contrasted with pneumococcic.

Picture the lesions—they are widely different. The whole effort of the tuberculous lesion is to cut off the circulation and starve itself into a necrotic condition.

The pneumococcic congestion is very different. These points alone emphasise the difficulty in treating phthisis by any particular specific means, and the ease with which pneumonia yields to bacterial inoculation. There is something more, something, which shows itself more openly with phthisis than, I think, with any other infection, namely, the inherent power of the individual to respond to inoculations, whether artificial or self-induced. What this response is in set terms, other than the production of antibacterial substances, and antitoxins, for the present it matters not, but, clinically, I do know this—that all the young people I have inoculated, who have been infected with a rapid form of phthisis, respond very feebly to Koch's tuberculin in minimal does; but with older patients, whose history shows attempts at self-immunisation, the results have been very encouraging; but here, again, we are often confronted with cavities—potential abscess cavities—which we cannot drain.

Perhaps with tuberculosis—and we had better go on with this infection, as we have drifted deep into this part of the subject—the most favourable cases are those of young children infected with tuberculous glands. I am firmly of opinion that a delicate child, with a few shotty glands in the neck and a few in the groin, has probably many more shots in the locker of the mediastinum and mesentery. The most remarkable instance I have had of this kind was a baby of eleven months, always crying and whining, pale, wasted, big-bellied, who had bad nights, and to whom milk seemed poison. All I could find were small glands in his neck and in his groin. His opsonic index was ·3. Dr. Wells tells us that babies have no indices, and that they grow their indices as they cut their teeth. But anyhow this baby's indices grew rapidly under inoculation, together with himself; and three months after the first injection he was a sturdy child, able to take milk well, and behave as

normal babies do. This is now 18 months ago, and he has shown no sign of falling off. Far more commonly infected with tuberculosis are children from five years and upwards. Thin, pale, fretful, easily tired, with grey patches round their eyes, no appetite, a few glands in neck and groin, they present a picture seen by hundreds in a children's outpatient department.

Amongst the better classes, they are all too common. Food and change of environment, except at the seaside, does little good. Opsonically they are generally low; probably the auto-inoculations are slight, and the stimulus to self-immunisation correspondingly feeble; the slow toxin absorption is gradually pulling them down. They emerge into youth, usually delicate, but at this age generally eventually immunise themselves.

I have had considerable experience in general practice with this type amongst the well-to-do, and, during the last three years, I have invariably adopted the course of tuberculin inoculations. At first, in 1905, the doses were about $\frac{1}{1000}$th to $\frac{1}{2000}$th of a m.g., now they have been reduced to $\frac{1}{4000}$th to $\frac{1}{5000}$th. With such a dose given at varying intervals, according to the opsonic necessities of the case, the results are most satisfactory. The children became less fretful and more high spirited, they eat better; their skins become mottled and glow with health; they are no longer delicate.

I would, however, caution you not to abandon them too early; after six or eight months they will often begin to drop back again; and there is danger of further tuberculous infection perhaps even in their joints, but seldom in their lungs.

I was asked the other day with reference to these particular children if inoculation made them more dependent upon it than if they had never had it.

My questioner was not an Irishman, but it sounded as if he was. What he meant was, "Did they go back to a worse state after inoculation, and was it therefore necessary always to continue it?" My belief is that they can be gradually immunised out of the tuberculous condition because it is possible gradually to space out the inoculations; but, at the same time, I think no sane man would venture an exact forecast in tuberculous infection. It is sufficient that they

rapidly become robust, and do not waste their early years, precious for development, in fighting the tubercle bacillus.

Lupus has not been very satisfactory in my hands; I have not had much experience of it, and it requires much more time and attention than people are disposed to give to it.

I will not say more about it than refer you to Bulloch's classical papers, published originally in THE PRACTITIONER[1] and the *London Hospital Gazette*.

Tuberculous meningitis in one case absolutely failed to respond to inoculation, although the patient did respond when primarily attacked with a tuberculous pleurisy a year before.

I blame myself that I lost sight of her, and did not continue the inoculations. Wright informed me that he had had a similar experience in a case of tuberculous meningitis.

In tuberculous disease of bone the surgeon may be greatly helped by bacterial inoculation; guided by the opsonic index, as has been shown during the last three years at St. Mary's Hospital in particular.

The staphylococci, upon which Wright[2] elaborated his principle of opsonic investigation and bacterial inoculation, do not call for special notice.

The principles enunciated above, as regards blood stream and drainage, of course particularly apply in this infection. I notice that the dermatologist is particularly scathing in his criticism of bacterial inoculation for acne; but if he merely inoculates, and does not take care to soften the indurated patches and help the peripheral circulation, he violates the fundamental principles. I have in mind a lady of fashion, who had one small disfiguring patch on her right cheek, at times red and hard, but seldom forming pustules. Staphylococcic inoculation did no good, until, following Bier's cupping method, I covered the patch with a heated wineglass. This worked far better than hot fomentations, and in a week the patch, which had existed for two years, had gone. Her index was 1·4 to her own staphylococcus, and the vaccine had been prepared from her own cultures from a spot on the chin.

The staphylococcic boil usually yields at once to bacterial

[1] THE PRACTITIONER, November, 1905.

[2] *Lancet*, September 14, 1901. *British Medical Journal*, May 9, 1903, and May 7, 1904.

inoculation, and those troublesome painful little pimples in the external auditory meatus rapidly disappear after months of discomfort.

Certainly in carbuncle a staphylococcic vaccine should always be used.

I have used staphylococcic vaccine in a bad case of burns on the arms and hands at a period when the interstitial tissues were being rapidly eaten away and the tendons exposed. Three inoculations at intervals of a week caused healthy granulation and quick healing.

A man in good position recently consulted me for general chronic eczema. There was much exfoliation, cracking of skin, serous exudation through the cracks, irritation, and general misery. He had had periodic attacks for the last 15 years, and was always worse in London. Fresh air and sunshine sometimes cured him as long as he was in the country. Cultures made from various serous exudations in various parts of his body all yield pure cultures of staphylococcic aureus. His index to this micro-organism was ·5 and ·4.

A vaccine was made from the cultures, a short series of inoculations were given with the result that his skin became clean, soft, and supple. His index rose to 1·5 and 1·7. Five weeks after the third inoculation he came to see me again; there were a few slight patches just starting. I inoculated him with 100 m. and when he came to see me the next week everything had disappeared, and his skin was soft and smooth.

On the whole in staphylococcic infections a common vaccine will suffice, but occasionally it happens that it is necessary to make a special vaccine from the particular infecting organism. I find this necessity occurs more often in skin lesions.

The infections produced by the coli bacillus are very varied. The conditions, which I have most frequently met with, are—

(1) Coli infections of the bladder and kidneys;
(2) Coli infections of the uterus;
(3) Mucous colitis.

The bladder infections by coli, as everyone knows, seem impossible to cure under the usual regime, and I have invari-

ably found that coli thrive in urotropinised urine. Generally, however, when a coli vaccine in a dose of 5 to 30 millions is used systematically, the cystitis disappears, and disappears often long before the bacillus has vanished from the urine. Coli infections of the kidney have not been satisfactory, in my experience, if there has been long standing mischief; these cases usually require surgical interference, and then do well if a high index is maintained. It not infrequently happens that a coli infection of the kidney occurs secondarily to a tuberculous lesion. When this occurs, and a sinus has been established, coli inoculation does little good locally. Here again a fresh surgical start seems necessary under the auspices of a high opsonic index.

An interesting group of infections are the very numerous cases of slight endometritis with cervical catarrh. I have found that a large proportion of these are caused by the coli bacillus. Besides the usual local conditions, I have noticed a patchy browny-yellow discolouration of the skin, particularly on the forehead and on the cheeks near the ears; in some cases, a general sallowness with anæmia occurs without any particular marking. The alteration in complexion varies, pari passu, with the local condition, and is worse when the opsonic index to the coli is low. It is very often better after a menstrual period, when the index rises, owing no doubt to auto-inoculations.

I have found that very small doses of a bacterial vaccine (5 mill.) of the coli, given usually a week after the period, and repeated a week before, cure the local infection, abolish the discolouration, and improve the general health. The treatment has, however, to be continued for a considerable length of time, six months, but the gain is, I think, on the whole worth the labour.

There can be little doubt that curetting such cases produces a marked auto-inoculation, and brings about a state of surgical freshness of the tissues which, as I have stated before, is indispensable to local immunisation. One case is particularly in my mind: the patient had been curetted three times in 10 years, and was always ailing and anæmic. Bacterial inoculation was started in April 1906, continued fortnightly during the summer, monthly during the winter,

and finally left off in the summer of 1907. The patient's uterus became healthy; she lost her anæmia; recovered her energy, and has not since relapsed.

When these cases fail to improve under inoculation it is wise to curette, on the general principle of removing damaged tissue, which I have discussed earlier.

In mucous colitis, caused by an infiltration of the coli bacillus, good results have been obtained. The subject is difficult, as one has frequently to deal with more than one form of coli.

We must also look to bacterial inoculation as a medical weapon in the treatment of appendicitis in its milder aspects.

The formation of gall stones is, as Wright has shown, due to the infection of the gall bladder with the coli bacillus. Recently I obtained some gall stones which had been passed 10 years before, and obtained perfect specimens showing no signs of autolysis of coli bacilli on a slide from the centre of the stone. I, however, failed to procure a culture.

A remarkable case of cystin calculi is now under my care for coli inoculation. The calculi were removed surgically; but the coli bacillus is causing trouble in the bladder. I have obtained one of these calculi from the museum at Guy's for bacterial examination, but it does not appear to contain any coli.

The last vaccine I have to mention is that of Malta fever. That it is valuable there is no doubt, but the immunising factors in this disease are at present obscure.

I have certainly obtained marked results in the two cases which I have inoculated. The important points in treatment by inoculation for this disease are rest and warmth. The naval authorities at Haslar state that they have met with little success with this treatment. Wright and Douglas[1] have on the whole obtained satisfactory results.

I am inclined to think that this failure is due to inattention to these points. I have known a slight walk produce a big negative phase, and a chill on a cold day cause a sudden drop in the opsonic index. On both occasions a recrudescence occurred.

Of the gonococcus vaccine I have had no experience.

[1] *Lancet*, Nov. 2, 1907.

Douglas and Wells, in St. Mary's Laboratory, have met with a great deal of success, but I am unable to give any details.

Micrococcus-catarrhalis is causing a good deal of interest by reason of its nasal and throat infections. I have tried a vaccine in two cases, but the results were not satisfactory. There is too much irritation of the mucous membrane in and near London by foreign particles to allow of any accurate deductions.

To sum up, these to me are the cardinal points to be observed in the use of bacterial vaccines :—

(1) Appropriate vaccine ;

(2) Appropriate dose, at the right time ;

(3) The factors which militate for and against local or general immunisation, and as regards local immunisation, the importance of the circulation.

I have endeavoured to show that the use of bacterial vaccines is but a link in the chain of general treatment of which medicine stands at one end and surgery at the other. It is as much a part of medicine as it is of surgery ; and though, perhaps, now rather a special study in itself, may largely in the future replace the pharmacy of the past.

A TABLE OF VACCINES.

Vaccine.	Relative Toxicity.	Doses.	Frequency of Inoculation.
Tuberculin -	Very Toxic - -	$\frac{1}{2000}$th to $\frac{1}{10000}$th m.g.	Every 10 days.
Coli vaccine -	Very Toxic - -	5 to 15 millions.	Every 2, 5, 10 days.
*Pneumococcus vaccine.	Less Toxic than Coli -	10 to 50 millions.	Every 36 hours. or 48 hours.
*Streptococcus vaccine.	More Toxic than Pneumococcus.	20 to 60 millions.	Weekly, and every 2 to 3 weeks.
Staphylococcus vaccine.	Less Toxic than Streptococcus.	100 to 1,000 millions.	Every 10 days.
Malta fever vaccine.	- - - -	$\frac{1}{10}$ sq. cm. cult.	7 to 14 days.

* Acute infections appear to yield by crisis after one or two inoculations, *e.g.*, pneumonia, erysipelas.

I have appended this table as a rough guide, based on the work that has been already done.

THE VALUE OF THE OPSONIC INDEX IN THE TREATMENT OF PULMONARY TUBERCULOSIS.

By A. C. INMAN, M.A., M.B., B.Ch., Oxon.,
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It is proposed in this article to deal with the processes of natural resistance to tuberculous infection, the part taken by the blood itself for its own protection and defence, and to consider the use we may make of them in the treatment of consumption. The discovery of the tubercle bacillus by Koch a quarter of a century ago dispelled the belief that consumption was hereditary, and placed it among the bacterial infections. Extensive researches, based upon this discovery, most of them in the post-mortem room, have resulted in an accurate diagnosis of the various stages of pulmonary tuberculosis from the earliest infiltration to the complete breaking down of the lung, on the one hand, and to healing by fibrosis, on the other. It seems to be established, by careful post-mortem observations, that most people over thirty years of age have encountered the tubercle bacillus at some time or other in their lives. It follows, therefore, that there must be a natural resistance to the infection, by means of which the body has been able to overcome the invading microbe. Of recent years, largely owing to the labours of Sir Almroth Wright and his fellow workers, a great advance has been made in our knowledge of the working of this natural resistance, and in consequence we are in a position to treat the disease by more effective and more rational methods.

The most important step in advance was made when Wright announced his discovery of new substances in the blood serum which participate in the work of resistance to microbes. These he called opsonins, from their apparent tendency to render the offending bacteria more palatable to the phagocytic white blood corpuscles, their function being to facilitate the seizure of the invaders by these "policemen of the body," as the late Sir John Burdon Sanderson called them, and so to hasten their eventual destruction by the

ferments, which may have their origin in these leucocytes. It may be possible, at some future date, to describe this process with greater scientific accuracy, but the practical issues are beyond doubt. In order to enable the medical profession to utilise them, Wright has supplied a technique, by means of which the amount of these protective substances, present in any given specimen of blood, can be measured ; and, moreover, a deficiency or increase in their number can be determined with equal facility, the latter only having been possible in the case of previously known protective substances. The technique needs but simple laboratory instruments, and may be acquired by any one who will give the necessary time and application to it ; it is useful, of course, only in the study of diseases of which we know the causative agent. Fortunately, consumption is one of these.

During the last four years, a great deal of attention has been directed to the study of opsonins, both from the practical and from the scientific point of view. The latter does not concern us now, as our purpose is to deal solely with the value of these recent discoveries in respect to the treatment of one disease, namely, pulmonary tuberculosis.

But before reviewing the special work done in connection with the treatment of consumption, we must state some of the fundamental principles upon which it has been based. These are the results of the study of opsonins, and of the part they play in natural and artificially acquired immunity. It would be obviously difficult to gauge the effect on the blood of a sudden arrival of pathogenic organisms in the body, even though it were possible to examine the blood immediately before and after the invasion. But an almost absolutely similar condition can be artificially produced by the introduction into the body of bacteria of the same kind, which have been killed, and so rendered incapable of multiplication. If a certain number of tubercle bacilli are killed and suspended in physiological salt solution, and are then injected subcutaneously into a human body, a definite succession of changes takes place in the opsonic content of the blood, provided that the dose of poison contained in the bacilli has been sufficient. There is first an immediate diminution of the number of opsonins ; this is followed by an increase above the normal ;

and then a gradual return is made to the normal number. These phases have been defined by Wright as the negative phase, the positive phase, and the phase of maintained high level.

It is important to realise that this definite succession of changes follows upon a *single* inoculation, and, during the vaccine treatment of localised bacterial infections, it is reproduced with almost mathematical accuracy after each inoculation. Now if the blood of a patient, suffering from advancing pulmonary tuberculosis, is examined from day to day as regards the opsonic index, it is found, that in an absolutely irregular way, without apparent rhyme or reason, the index is constantly varying; negative and positive phase succeed each other at irregular intervals. We are dealing here with irregular inoculations of unmeasured poison, and these doses of poison are coming from the focus of infection in the lung where the bacilli are multiplying, that is, they are the result of *spontaneous auto-inoculation*. These auto-inoculations only take place when the focus of infection is in direct communication with the general blood- or lymph-stream, and constitute the main source of danger to the patient suffering from such a lesion. Unfortunately, the consumptive patient is too often in this condition, especially by the time he comes to the medical man for treatment. These unmeasured doses of tuberculous poison must clearly be stopped if the patient is to gain the ascendancy over his disease; and the obvious way of obtaining this end is to remove the conditions which excite such auto-inoculations. and to make it as difficult as possible for them to recur. On the subject of the conditions which excite auto-inoculations we can learn much from the investigations of Freeman on the effect of massage on gonococcal joints. These investigations have shown that any movements, passive or active, which are sufficient to affect a focus of infection, result in a discharge of poison into the system, and that this discharge produces the same effect on the blood as an artificial inoculation. To such inoculations the name of *artificially induced auto-inoculations* has been given.

Our first duty, therefore, to the consumptive patient, who is suffering from irregular auto-inoculations, is to give him rest, and to stop as far as possible every movement which is not

necessary. In the next place, we may adopt means to render the blood more sluggish, and so to slacken the flow. Wright's studies on the coagulability of the blood suggest salts of calcium as a useful drug for this purpose. A milk diet also tends to produce the same effect, and this, no doubt, has been one of the unrecognised advantages secured by its universal use in cases of consumption. In fact, the general treatment of consumptive patients, which has erred in being used for all alike without discrimination, forced feeding, excess of milk, and absolute rest, has gone very much on the lines required by the special cases under consideration. This is a rational and appropriate treatment for these active, advancing cases, in which the first and essential need is to stop the flow into the system of unmeasured, irregular, doses of a living culture of tubercle bacilli or their products. In dealing with cases of consumptive patients in the earlier stages of the disease, it is a matter of the greatest importance to decide whether to rely upon artificially-induced auto-inoculations, or upon artificial inoculations of a tubercle vaccine, and, in coming to a decision, it must not be overlooked that the extent of the lesion and the degree of communication with the blood- and lymph-streams are of all grades. A useful comparison may be made at this point between a local tuberculous lesion on the skin and a small chronic deposit at the apex of one lung. In each case a blood examination reveals the same condition—absence of auto-inoculation and a persistently low opsonic index. Now I am sure that those, who have had a number of cases of localised skin tuberculosis under their care, and have attempted to immunise the patients with tuberculin, will have experienced a certain number of brilliant successes and a few absolute failures. In like manner those who have used Bier's passive congestion method—a method which, in the light of recent research, depends for its efficacy upon artificially-induced auto-inoculations—have also met with brilliant successes and with failures. In the same way, curative effects will be produced in quite early pulmonary tuberculosis by the use of tuberculin inoculations, or by means of auto-inoculations artificially induced by allowing the patient to take *sufficient* exercise.

These are not cases which come in any number to the medical man for treatment, and, in the majority of them,

ordinary attention to the usual hygienic measures and good feeding will effect the desired cure. But when dealing with a rather more advanced case, one which is most readily recognised by the fact that slight over-exertion produces a rise of temperature over the normal, loss of appetite, and exhaustion, the question becomes more complicated. In theory, the ideal treatment should consist of reduction of auto-inoculation, and then artificial immunisation with tuberculin. But, clinically, these cases want more than this: the loss of weight, and poor general condition of body and mind, have to be corrected, if the patient is to be sent back to his home and his work in the shortest possible time. To effect this, we must look beyond the injections of tuberculin, and must take the patient to pure invigorating air and healthy surroundings, and put him through a course of physical exercise carefully graduated for his individual needs and condition.

It is along these lines that Dr. Paterson has been treating,

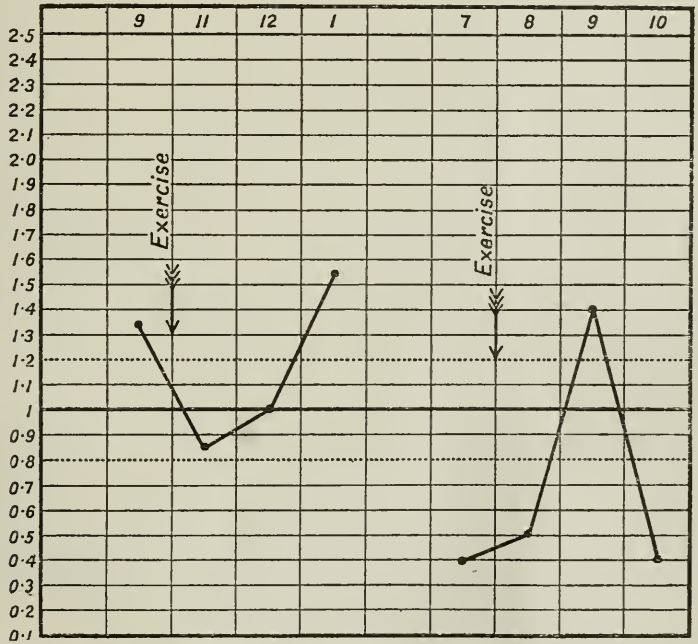

Chart 1.—*Shows characteristic variation in index of tuberculous subjects as the result of exercise.* (a) *Those starting high go down after exercise.* (b) *Those starting low go up after exercise.*

during the past two and a half years, the patients under his care at the Brompton Hospital Sanatorium at Frimley. In a very suggestive communication to the Medical Society of London (*Lancet*, January 25, 1908), Dr. Paterson has described in detail his system of graduated labour in the sanatorium treatment of afebrile pulmonary tuberculosis. Subjecting his patients, as he does, to various grades of physical exercise, from gentle walking to the fullest navvy work, he is able to show results which, so far as can be judged at present, are not surpassed by any hitherto obtained in the treatment of consumption. Dr. Paterson's patients at Frimley were tested for a period of four weeks by means of the opsonic technique, which not only corroborated the soundness of his methods, but explained their *rationale*. The results of these

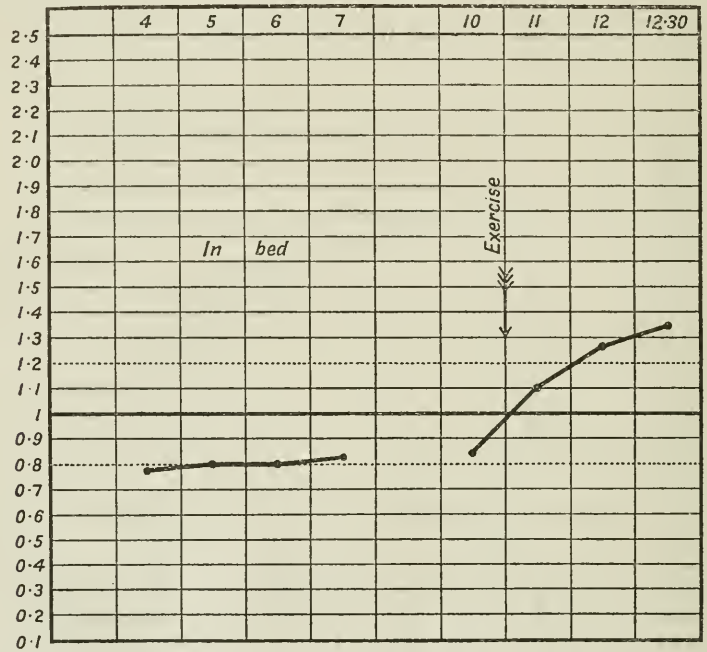

Chart 2.—*Whilst in bed the index remains normal. The effect of exercise, in this case, is to cause a rise in the opsonic index.*

tests in a number of typical cases we will examine. But, before doing this, let us remind the reader that any movements, which are sufficient to affect a focus of disease, cause

auto-inoculations; that is to say, the patient receives each time a dose of tuberculin from the site of infection—in the cases we are considering, from the lesion in the lung. This inoculation is traced in the blood by a variation in the opsonic index, which does not take place in the case of normal individuals.

Chart 2 shows that the exercise determines this variation. The first curve is the index at rest, the second the index before and after exercise.

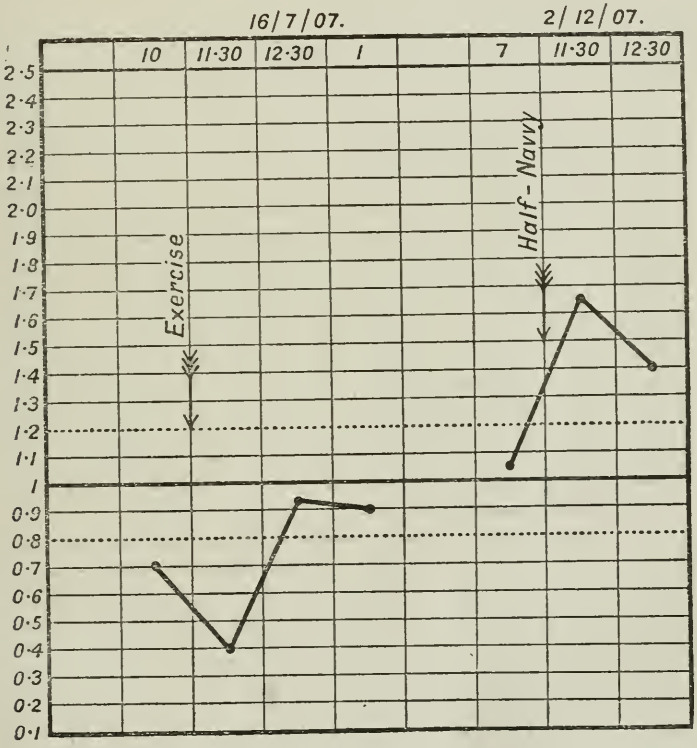

Chart 3.—*The amount of exercise taken when the blood was first examined at the Brompton Hospital had the effect of lowering the opsonic index (curve 16/7/07). After a course of graduated labour the index is above the normal (curve 2/12/07).*

An inoculation, which produces a beneficial effect upon the health of a patient, is measured by a sustained rise in the opsonic index, that is, by a positive phase; whereas an

overdose of tuberculin causes a fall in the index, a negative phase, with its usual accompaniments, fever, headache, malaise, and loss of appetite. So that as long as the blood of patients, undergoing the graduated exercises as a method of treatment, shows an opsonic index above the normal, we have scientific proof that the exercise is neither excessive nor insufficient, and that it is exciting auto-inoculations which are beneficial. This summary of opsonic principles will enable the reader to appreciate the following excerpts from the Frimley tests, and the corresponding charts of the opsonic index which accompany them.

The first cases are those of patients whose opsonic index was found to be below the normal before they commenced

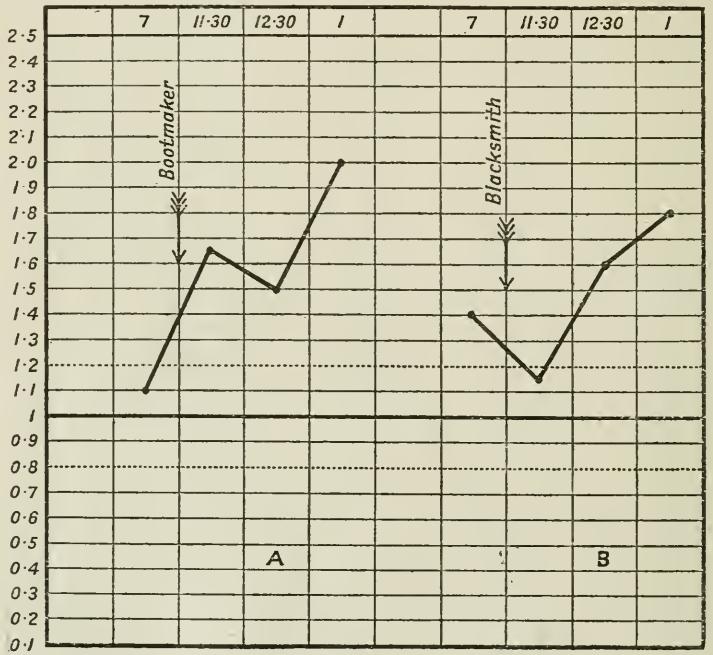

Chart 4.—*The indices, before and after work, of two patients. Both are well above the normal.*

their allotted physical exercise, and rose well above it during the treatment, with a corresponding improvement in general condition. Ninety-five per cent. of the patients working in the different grades appointed by Dr. Paterson—walking,

carrying loaded baskets, digging, navvy work—had opsonic indices above the normal some time during the day.

During the month in which these tests were carried out, only two transient instances of over-dosage occurred, and in both cases the slight fever, malaise, loss of appetite, etc., were accompanied by a negative phase, which lasted quite a short

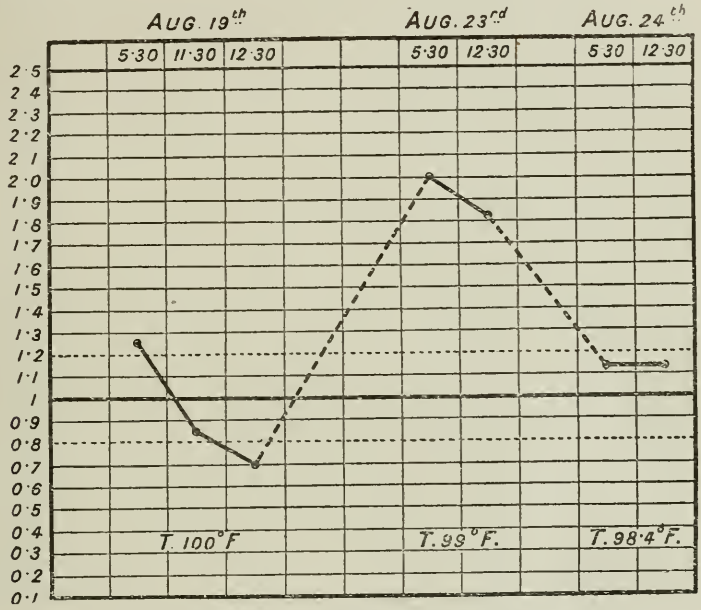

Chart 5.—*Excessive auto-inoculation.*

time, and did no appreciable harm. No stronger proof is needed of the extraordinary precision with which Dr. Paterson's long experience has enabled him to measure the capacity of each individual patient, or of the value of the opsonic technique in indicating at once the slightest errors of judgment.

We may now consider cases, which have passed through the various grades of exercise, and have reached the stage when their fitness to return to the work in which they have been brought up has to be decided. At this period the opsonic technique is invaluable, as by means of the index the arrest of the disease is scientifically registered. When a focus of disease is no longer active all auto-inoculation from that source must cease, and consequently no variation will be then seen in the opsonic index after exercise. In two

patients, the actual transition from a high to a normal index, before and after the hardest navvy work, was actually observed. And in several patients, who had lost all expectoration and tubercle bacilli, and were doing a full day's work without discomfort, the blood was found to be normal. The assurance

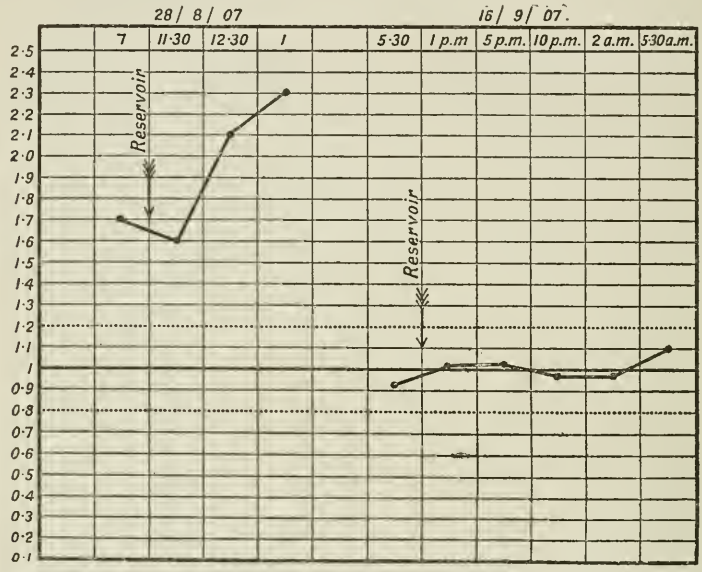

Chart 6.—*The first curve shows a very high index. The second (one month later) a normal index over* 24 *hours, hard labour being performed from* 10 *a.m. till* 1 *p.m. on the day in question.*

given by the index that arrest of the disease has taken place is of the utmost value.

Then there are cases of an exceptional character which should be noticed. A patient, who was physically fit and able to do a full day's work, upon whose blood the hardest exercise had no effect, nevertheless had a small amount of expectoration containing tubercle bacilli in the early morning. Such cases have been observed for a number of years. Dr. Kingston Fowler, in his book on *Diseases of the Lungs*, quotes the case of a man, who was able to perform his daily work for 14 years after his disease was discovered, and yet never lost tubercle bacilli from his expectoration during the whole of this time.

Another case at Frimley was one of idiopathic pleurisy, which responded in a remarkable way to the Sanatorium

labour treatment. The patient, a young man of 17, was admitted to the Brompton Hospital with pleurisy accompanied by effusion at the left base. After rest in bed the effusion was completely absorbed, and the fever, which at first had been considerable, subsided. The opsonic index, was taken on the first day the patient was allowed to get up, and was found to be well above the normal, though the gentlest

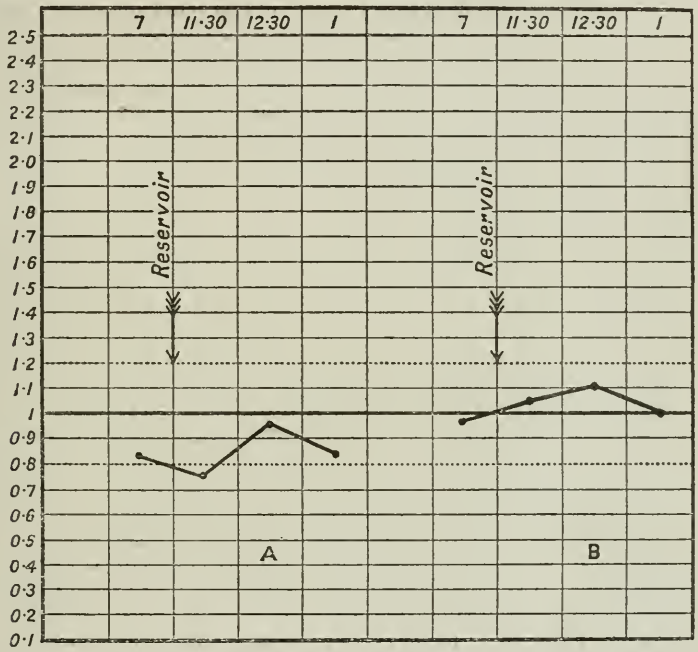

Chart 7.—*Practically normal indices before and after the hardest work in two patients who had lost all expectoration.*

exercise caused it to fall. He was transferred to the Sanatorium, and there underwent graduated labour, until he was able to do the hardest work, being employed in building a water reservoir. Just before discharge his blood was examined, and found to be normal before and after this hard exercise. Calmette's recent work suggests that these patients have, for a length of time as yet undetermined, an increased resistance to tuberculous infection.

The examination of the blood of tuberculous patients, undergoing the graduated labour prescribed by Dr. Paterson at the Brompton Hospital Sanatorium, gave practically no indications

of a lowered resistance to tubercle, but on the contrary an increased resistance was proved to be the rule. It is established that the exercise induces auto-inoculations; these inoculations consist of unmeasured doses of a living culture of tubercle bacilli or their products; and yet nothing but benefit can be said to have resulted in these afebrile cases. It would seem that great freedom of treatment is possible in the case of the tubercle bacillus, much greater than in the case of such virulent bacteria, as, for example, B. typhosus, B. diphtheriæ, streptococci, pneumococci, or the colon bacillus. In infections by such types of micro-organisms treatment by artificially-induced

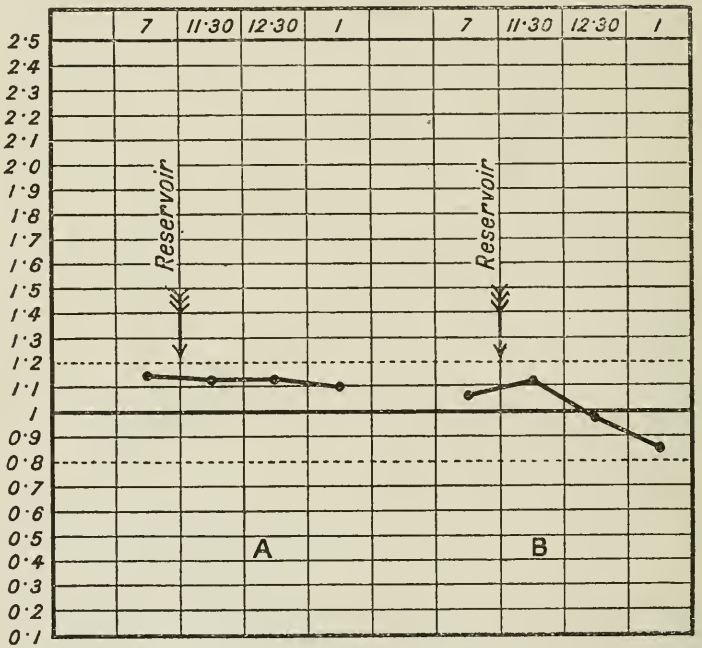

Chart 8.—*Normal indices, before and after hardest exercise. Tubercle bacilli were still present at the time the blood was examined. One of the patients has since lost the tubercle bacilli from the sputum.*

auto-inoculation would probably be out of the question, and certainly in point of safety could not compare with inoculation of the corresponding bacterial vaccines. But where artificially-induced auto-inoculations can be used, as in the treatment of afebrile consumption, there is this manifest advantage: the patient is inoculated with his own tuberculin, whereas if stock

tuberculin is used we cannot be certain that it corresponds with that with which he is infected. It is possibly due to this fact that the indices found in patients at Frimley were so high.

The opsonic index is a valuable guide to the amount of exercise which a patient may take with advantage, and in this way can materially shorten the time during which a patient must remain at any given grade. The duration of the treatment can thus in many cases be diminished, a matter of no small concern to the patient and to the institution.

As regards cases of early pulmonary tuberculosis, the merit of any form of treatment can only be gauged in terms of "relapses." When a sufficient time has elapsed for this test to be applied on a wide scale, the use of tuberculin will probably be found to have produced satisfactory results in reducing the number of relapses. Already it may be said that those who have had an extensive experience of tuberculin treatment speak highly of it from this point of view (Turban, Trudeau, etc.). It is certain that similar satisfactory results will be obtained by graduated labour in connection with Sanatorium life. In both forms of treatment better and more striking results will be obtained when the human judgment is guided by the unerring figures of the opsonic index.

The treatment of advanced cases of the disease, in which the presence of fever forbids movement, remains to be noticed. The chief hope appears to be in the judicious administration of tuberculin. That great improvements are possible in the methods used in this form of treatment goes without saying, and as the subject of immunity becomes better understood, and new lights are thrown upon it by the researches which are being made in many quarters, we may reasonably look for much better results. In those advanced cases, in which other infections are present than those of the tubercle bacillus, efforts should be made to combat them by means of vaccines.

SUMMARY.

1. Early or febrile cases of pulmonary tuberculosis may be treated with advantage by means of pure air and graduated exercises. When such treatment is undertaken it must be

borne in mind that "tuberculin by auto-inoculation" is being used.

2. The opsonic index is a valuable guide to such treatment, and also gives useful information if inoculations of Koch's tuberculin are employed.

3. Rest is essential in febrile cases of consumption, and in these cases injections of tuberculin, using as a guide the opsonic index, is the treatment indicated.

The reader will gather from what has been written that the latest methods of treating consumption are those which aim at co-operating with the natural methods employed by the body itself for its own protection and defence. Where it is possible, as in the afebrile cases at Frimley, the body is made to carry on its own continuous inoculation, the efforts of the physician being directed to prevent excess or deficiency. Where, as in febrile cases, this cannot be done without harm, the need is supplied artificially. And in both cases a watch is kept over the blood by means of the opsonic index, so that the conditions may be maintained under which "the policemen of the body" can best discharge their duties.

THE TREATMENT OF PULMONARY AFFECTIONS BY THE INOCULATION OF VACCINES CONTROLLED BY THE OPSONIC INDEX.

By J. CHARLTON BRISCOE, M.D., M.R.C.P.,
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E. U. WILLIAMS, M.R.C.S., L.R.C.P.,
Resident Medical Officer at St. John and Elizabeth's Hospital.

THE treatment of chronic and subchronic pulmonary infections has been, perhaps, less satisfactory than the treatment of similar diseases in other parts of the body, and any improvements are to be welcomed. Therapeutic vaccination has proved satisfactory in some diseases affecting organs other than the respiratory. Based as it is on the theory of more active phagocytosis, rendered possible by an increase of opsonin, the results must to a certain extent be dependent on the two factors, namely, (1) the phagocytes and (2), the facility with which opsonin can arrive at the site of infection. Good results ought, therefore, to be obtained in those situations where phagocytes are naturally present. Of cells generally, the chief phagocytic activity is no doubt to be attributed to the polymorphonuclear leucocytes, but one of us (J. C. B.[1]) has shown that many other cells are endowed with this property. Probably the cells lining the alveoli of the lungs possess phagocytic properties as great as any in the body, and their anatomical position is such that plasma can easily pass from the blood-vessels to the alveoli. They are, therefore, ideal situations for the phagocytosis of organisms. Indeed one of us (J. C. B.[2]) was able to show experimentally that the alveolar cells are able to deal with a mild infection without the aid of the polymorphonuclear leucocytes, whereas the more severe the infection the greater is the help given by the leucocytes. Cases of abortive pneumonia may probably be explained on these grounds, as also the fact that alveolar consolidation is not more frequent than is actually the case. The cells lining the bronchi are ciliated and non-phagocytic, and in the bronchioles only weakly phagocytic, so that, in these situations, the poly-

morphonuclear leucocytes must remove organisms, which are not got rid of by ciliary action or by the bacteriolytic action of the serum. On anatomical grounds, we may conclude that both plasma and leucocytes can the more readily gain access to the different parts of the bronchial system in proportion to the thinness of the wall of the bronchiole. We should, therefore, expect that treatment by therapeutic vaccination would be more efficacious in those diseases in which the alveoli and bronchioles are involved than in lesions of the larger bronchi. It must however be remembered that, in most chronic pulmonary infections, the disease is by no means limited to those regions to which air penetrates, but the surrounding tissue is also involved. In such sites, the general conditions are similar to those in other parts of the body, except that it is not possible to produce such perfect rest in the lungs as in other organs. Whether this is a favourable factor or not probably depends largely on the nature of the infection, for, in the lungs, as elsewhere, activity produces increased circulation in the lymphatic and circulatory systems. Moreover, in chronic unresolved pulmonary affections, fibrous tissue is formed, and by its inevitable contraction produces deformities which are attended by structural changes. Hence it follows that every means should be employed to hasten the absorption of such conditions as unresolved pneumonias in order to prevent the formation of bronchiectasis, etc.

On these grounds, we have treated such cases as showed unresolved lesions which were not improving under ordinary treatment by the method of therapeutic vaccination, controlling our inoculations by the results obtained from estimating the opsonic index. We here record all the cases so treated whatever the result.

When an exploratory puncture of the chest is made, if pus or fluid is not present, the needle passes into the lung tissue. On squirting out the contents of the needle, and examining them microscopically, lung tissue, blood cells, leucocytes, and organisms can be detected. If some of this material is then inoculated into an agar tube, a growth is obtained on incubation, from which a subculture and subsequently a vaccine can be made. In several cases after lung puncture, the lesion has cleared up without requiring vaccine

treatment, as might indeed be expected. In other cases, the culture was obtained by washing and teasing purulent portions of the sputum in sterile salt solution, and then inoculating some of the fragments on to agar or other media. It is well to make the patient rinse the mouth with some sodium bicarbonate solution (20 grs. to the ounce), discard the first two or three pellets, and then expectorate once or twice into a sterile plugged bottle. The vaccines in the non-tuberculous cases have been made from the cultures thus obtained from the lesion or from the sputum. In empyema cases, the pus can be obtained direct from the chest or sinus.

We have thus treated four cases of unresolved consolidation of the lungs in the early stage, three in infants and one in an adult, and one anomalous case in a child.

In the first case a successful result was achieved accidentally, as the vaccine was injected for the purpose of clearing up a crop of boils. A child, aged two, was admitted to the Evelina Hospital under the care of one of us, with consolidation at the right apex, and two days later, developed consolidation at the right base, the apex remaining unresolved. An exploratory puncture was performed on the eleventh day; no pus was found, but, in the stained film made from the contents of the needle, cocci were seen which did not resemble pneumococci in shape, and had no capsule. They were thought to be staphylococci. The child's temperature was falling, so no injection was given. The signs of consolidation did not disappear with the fall of the temperature. On the 21st day, three boils appeared, and from one of these staphylococci were grown and a vaccine prepared. On the 22nd and 23rd days, the temperature rose to 100. On the 24th day, a dose containing 50,000,000 dead staphylococci was given, and the lung signs cleared up within three days. Four days after the injection two more furuncles occurred on the buttocks, and three days later the child developed scarlet fever. No relapse in the lung condition occurred, and no more boils developed. On the 23rd day of the illness, the index to staphylococci was 1, on the 27th day (three days after injection) 1·4, and on the 30th day 1·3. The second crop of boils developed while the index was high, but rapidly got well. In this case the consolidation was almost

certainly due to staphylococcus, and the result shows that the lung cleared more readily than the cutaneous lesions.

Case 2.—A child, aged $1\frac{6}{12}$, was admitted August 2nd, 1907, to the Evelina Hospital with general bronchitis and consolidation of the right base. By the middle of August the bronchitis had disappeared, but the right base was still unresolved at the end of the month. On exploration, no pus was found, but a culture from the contents of the needle gave a growth of pneumococci. A vaccine was prepared, and on September 6th, 20,000,000 were injected. This dose produced a slight rise of temperature, and the child was not so well for 18 hours, but after this short period he improved in weight and general condition. On September 10th, there were only a few crepitations and slight bronchial breathing. On the 12th, crepitations but no bronchial breathing. On 17th, 10,000,000 were injected, producing no ill effect, and on the 19th crepitations were audible only at the lower and posterior aspect of the lobe. On the 22nd, 10,000,000 were injected, and on 23rd the chest was clear. The child had put on 1 lb. in weight between the 3rd of September and the end of the month. Index, September 4th, ·9; September 8th, 1·2; September 11th, 1·3; September 15th, 1·2; September 18th, 1·4; September 22nd, 1·1.

Case 3.—A child, aged $1\frac{9}{12}$, was readmitted to the Evelina Hospital, May 8th, 1906. He had been an in-patient in March with right basal, and later, right apical consolidation. The apical lesion had not cleared properly when the child developed measles, and was sent to the London Fever Hospital. The opsonic index to pneumococcus on admission was ·7, and rose gradually to ·9. No injection was given. On readmission the child was ill, and an empyema was suspected at the right base. On May 8th, exploration revealed turbid fluid (not purulent), from which a growth of pneumococci was obtained, and an injection of 20,000,000 was given on May 13th. The index, May 8th, was 1·2, May 12th, 1·1. Crepitations, which had been present at the right base, increased, and many were audible at the left base. The child got worse, developed an empyema of the tunica vaginalis, and died. Following the injection the index fell, being on May 15th and 17th, ·6.

Post-mortem, loculated septic pericarditis was found with universal mediastinitis, and collapse and consolidation of right lung, the left being œdematous.

Case 4.—A child, 2 years old, was admitted to the Evelina Hospital on April 3rd, 1907, and two days later an empyema was drained. The discharge ceased on May 23rd. The temperature continued to be intermittent, and on June 3rd, 10,000,000 pneumococcus vaccine, made from the organism present in the pus from the empyema, was injected. There were no definite physical signs in the chest at this time, but five days after injection, two small patches of tubular breathing developed in the right lower lobe and disappeared on the following day. As the temperature had not quite settled on June 11th, a second dose of 40,000,000 was injected. The child developed measles June 13th, and was sent to the Fever Hospital, and, subsequently, discharged well. The opsonic chart has, we regret to say, been lost.

This case was, unfortunately, complicated by the commencement of measles. The child's general condition showed improvement after the inoculation, and the temperature was slightly reduced.

A man, aged 44, was admitted into King's College Hospital under the care of Dr. Tirard—to whom we are indebted for permission to publish the notes of this case—December 8th, 1907, with right basal consolidation. The history pointed to an acute onset a week previously. The temperature, 102·6 on admission, fell by lysis, and was normal on the 13th. As the local condition was not clearing up, although there were no bad symptoms except mental depression, a vaccine was prepared from the pneumococcus in the sputum, and 60,000,000 were injected on December 22nd, and again on January 4th. After the first injection, the moist sounds cleared up entirely in the next three days, and the sputum diminished. Two days after the second injection, there was no bronchial breathing, but the breath sounds were a little harsh. His general and mental condition improved rapidly. The index on the 18th was 1·3, 22nd 1·1, 29th 1·4, January 1st ·9, January 5th 1·2.

In these, more or less acute cases, the improvement in the general condition is quite a marked feature, and it appears to be an important factor in the question of continuing the

treatment. The injection produces a stimulating effect, and the patients always seem to be more cheerful afterwards. An increase of weight occurs rapidly in the case of the children. In the first two cases the injection produced a rapid resolution. In the third, old standing septic pericarditis was present and the child died; and in the fourth, the temperature, which was believed to be due to a continuance of pneumococcal infection, may have been caused by the ensuing measles. In the adult case we consider the patient would have got well without injection, but believe his rapid resolution and his general improvement may be attributed to this treatment.

We have injected two cases of empyemata which were not progressing, the injection being first given, in one case, five days, and in the second case, 16 days after operation. The first patient showed general improvement, but it would not be claimed that the discharge was lessened, although the index rose in one case to 1·4. The second—a hopeless case—died a week later. In these small children, probably 20,000,000 pneumococci is too large a dose, and it is safer to begin with 10,000,000.

Two cases of a more chronic nature in adults were treated by injection.

(1) A physician, over 60 years of age, had a continuous cough, in part probably due to cigarette smoking. An examination of the chest revealed a patch of bronchial breathing, and crepitations in the left axilla. The sputum was examined, and from the purulent portions a small gram-positive diplococcus was obtained in pure culture. A vaccine was made, and 50,000,000 injected on Nov. 7th. The index on this date was 1·2, Nov. 11th 1·5, Nov. 18th 1. A second injection, 100,000,000 was given on November 22nd, and on Nov. 27th the index had risen to 1·7. On Nov. 29th, examination showed that the chest was normal. The sputum was somewhat diminished, and no longer contained purulent material. The history suggested that this lesion originated 10 months previously.

(2) A girl, aged 18, in good general condition, was admitted to St. John and Elizabeth's Hospital as a case of pulmonary tuberculosis. The history was of an illness commencing 10 months previously with an acute onset. There were signs

of consolidation over the left anterior axillary fold and at the right base below the seventh rib, with a few crepitations at the right apex. Repeated examination of the sputum never revealed tubercle bacilli, but constantly a small organism similar to the organism in the preceding case. A vaccine of this was made and injected. The right base almost cleared in a week, and the right apex at the same time, and since has been normal. A week later the right base was still better, but the left upper lobe was unaltered. A firm bandage was applied over the lower ribs with the object of making the upper part of the chest expand better. This had the desired effect of clearing the physical signs at the left apex. The injections were continued for four months, being required usually every 10 days. The index varied, generally being maintained above 1·5. We were never able to get rid of all physical signs at the right base, and the condition now suggests some degree of bronchiectasis in that region. She was and is in very good general health. Had the treatment been commenced earlier, complete resolution would probably have resulted.

Three cases in which the bronchial system was the site of the lesion have been treated.

(1) A child was admitted into St. John and Elizabeth's Hospital for pulmonary tuberculosis, but with no tubercle bacilli in the sputum. She came from a rescue home, and no past history is obtainable. There were attacks of dyspnœa, spasmodic in type, and much purulent expectoration. The physical signs were those of general bronchitis and patchy broncho-pneumonia with consolidation at the right base. The sputum contained an organism of the Friedländer pneumo-bacillus type (Gram-negative, profuse growth, "nail growth" in gelatin, and fatal to a guinea-pig). A vaccine was made and injected in doses beginning at 20,000,000 and rising to 100,000,000. The crepitations and signs of consolidation disappeared at the end of a month, and the cough and expectoration diminished considerably. There are now no attacks of dyspnœa, but intermittent bronchitic sounds, probably due to some bronchial dilation, are still present. The bacilli are still to be found in the sputum. The treatment has been continued for six months. At first the index showed

a positive phase lasting 14 days, but recently it has become shorter and now lasts less than a week. It is interesting to note that in this case the signs of consolidation disappeared readily, but the bronchitic condition persists.

(2) A sailor, aged 28, who had been subject to asthma and bronchitis for many years in winter, was admitted to King's College Hospital under the care of Dr. Tirard, to whom we are again indebted. His present attack began 14 days prior to admission. His chest was over-dilated, and did not expand laterally in inspiration. There were rhonchi and sybilli all over. Eosinophiles 6·8 per cent. of total leucocytes. The sputum was muco-purulent, containing many eosinophile cells, polymorphonuclear leucocytes, and many Gram-positive diplococci, some of which were taken up by leucocytes. He had paroxysms of dyspnœa, especially at night. Besides general treatment for the condition, a vaccine was made, and injections of 100,000,000 were given as indicated by the opsonic index on December 15th, 22nd, and January 4th. The character of the sputum changed rapidly, becoming less purulent, and more mucoid, and less frothy. But the attacks of dyspnœa were not altered, and though he ultimately recovered, this result could not be directly attributed to vaccination. The number of diplococci in the sputum was considerably diminished after the first injection, and very few were present after the third. The index was maintained between 1·2 and 2 for six weeks.

(3) An army man, aged 53, had bronchitis and asthma with exacerbations continually for two years, and had been invalided out of the army. He dated the onset of trouble to the siege of Ladysmith. He had general bronchitic signs, and a differential blood count showed 34 per cent. of eosinophile cells. Several operations had been performed on the nose, and he was referred to one of us by a rhinologist. An examination of the sputum showed a large number of organisms similar to those found in the case of the child referred to above. The child's serum clumped this organism and vice versâ, normal serum having no effect. A vaccine was made and 150,000,000 were given on October 11th, the index being 1·1, and going up to 1·4 on October 16th, and falling to 1·1 October 20th. On October 25th, another injection of

only 100,000,000 was given, as the former dose had produced some malaise, the index rising three days later to 1·7. On November 4th, the sputum showed no Friedländer's pneumobacillus, but small Gram-positive diplococci, some of which were included in the alveolar cells and polymorphonuclear leucocytes. A vaccine was made from this organism, and, on November 6th, an injection of 100,000,000 was given. Unfortunately he sent no blood after this. He was seen November 27th, and related that he had had a severe attack of dyspnœa with bronchitis commencing November 9th, and lasting four days. Since then he has had no cough or expectoration nor any more attacks. A letter received in the middle of February stated that there had been no relapse. This case is interesting, as showing that there were two organisms at work, and that convalescence was preceded by a severe attack.*

These cases demonstrate that the lesions, in which consolidation is present, yield more readily than where the disease affects the bronchial system.

We have, in the past eight months (June 1907 to January 1908), treated 20 cases of pulmonary tuberculosis in the open-air ward at St. John's and St. Elizabeth's Hospital, where 19 beds were placed at our disposal. For their courtesy in lending us 12 beds, we are indebted to Drs. Constable and Harold. The principle on which these cases were treated was that general treatment as regards open air, diet, and therapeutics should be the same as formerly, but that the injections of tuberculin should be determined by the results of the estimation (twice weekly) of the opsonic index. We have endeavoured to keep the index above normal, and have not allowed such patients as showed indications of auto-inoculation to be up and about. We have further not selected our cases, but have taken such cases as were recommended for admission when vacancies occurred. The recommendations are signed by general practitioners on the principle that the patients recommended are tuberculous, and are likely to benefit from

* In a short report of one of the Harveian Society's Meetings (*Medical Press and Circular*) Dr. Carmalt Jones reports 20 severe (sic) cases of bronchial asthma treated by this method, 16 showing definite improvement, and 11 some improvement. We have not been able to find the full report of this meeting in the Journals.

open-air treatment. Some of these cases turned out not to be pulmonary tubercle, and we remark that the type of case recommended varies from the hopeful to the almost moribund. Taking into account the fact that the treatment of tuberculous lesions, and especially pulmonary tuberculosis, based on the opsonic index, is quite recent, we have tried to obtain indications as to which cases would be suitable and likely to receive benefit. Besides careful notes of the physical signs, morning and evening temperatures and pulse rate recorded daily, and weighing weekly, we have estimated the coagulation time on admission; the hæmoglobin, red and white blood corpuscles, and the blood pressure, fortnightly. The sputum was examined on admission, and at the end of each month. The quantity of sputum was also roughly estimated.

As regards general treatment, all the patients were confined to bed for 14 days after admission, and were not allowed up for at least 14 days after the temperature was normal, with the exception of rising to defæcate, etc., and for a weekly tepid bath. The windows of the ward are kept widely open, and a free through draught is maintained. A liberal diet is allowed, and at least a quarter of a pound of raw meat is consumed by each patient daily. The only other therapeutic measures employed were sponging when sweating occurred, purgative and stomachic mixtures, and, in one instance, linctus.

We have not included any cases in which the diagnosis was not confirmed by finding tubercle bacilli in the sputum, nor any cases treated for less than three months (unless these were obvious failures). We shall, however, mention four cases which were not treated in the hospital, and in whom no estimation of the blood conditions other than the index were made.

The vaccine injected was at first *TBE*, but this did not raise the index satisfactorily, and was discarded for *TBR*. The dose employed varied between $\frac{1}{3500}$ to $\frac{1}{2000}$ of a ccm. of the original fluid, $\frac{1}{3000}$ (corresponding to $\frac{1}{1500}$ of a milligramme of solid substance) being found to be the most suitable.

In the following table, the cases have been divided into satisfactory, doubtful, unsatisfactory, died, and the data refer to the condition on admission. These divisions have been made

on general clinical grounds—increase in weight, cheerfulness, diminution of physical signs, of cough, expectoration, and of tubercle bacilli, normal temperature, etc.

Result.		Satisfactory.	Doubtful.	Unsatisfactory.	Died.
Number		8	4	4	4
Family history of Tubercle		4	3	2	3
Clinical type of onset.	Insidious	2	2	2	4
	Bronchial	3	1	2	0
	Hæmoptoic	2	0	0	0
	Laryngeal	1	1	0	0
Previous symptoms.	Sweating	2	2	2	2
	Cough	7	4	4	4
	Anorexia	0	0	1	1
	Dyspnœa	0	0	1	3
One lobe affected		3	2	1	1
Two lobes ,,		3	1	2	2
Three ,, ,,		2	1	1	1
Both lungs affected		4	1	1	3
Other tuberculous lesions		2	1	2	3
Other non-tuberculous lesions		1	1	1	1
Relationship of weight to height.	Over 100 per cent.	5	0	1	0
	90–100 ,,	2	1	3	1
	80– 90 ,,	1	2	0	1
	Below 80 ,,	0	1	0	2
Pulse tension (Rivi-Rocci).	Below 100 ,,	0	1	2	0
	100–110 ,,	2	0	2	0
	110–120 ,,	4	1	0	3
	120–130 ,,	2	0	1	0
	130–140 ,,	0	0	1	1
	Over 140 ,,	0	2	0	0
Colour index	Above 0·8	3	2	0	1
	Between 0·7 and 0·8	4	1	3	1
	Below 0·7	1	1	1	2
Number of red blood corpuscles per cubic millimetre.	Above 5 millions	5	2	3	2
	Between 5 and 4·5 ,,	3	2	1	1
	Less than 4·5 ,,	0	0	0	1
Number of white blood corpuscles per cubic millimetre.	Above 20,000	0	0	0	2
	Between 15,000 and 20,000.	1	1	2	2
	Between 10,000 and 15,000.	4	3	1	0
	Below 10,000	3	0	1	0
Average pulse rate per minute for first week of admission.	120 or over	0	0	0	2
	100–120	0	1	4	2
	80–100	7	2	0	0
	Below 80	1	1	0	0
Average of the evening temperatures during the first week of admission.	Over 100	0	0	1	4
	99–100	1	3	3	0
	Below 99	7	1	0	0

We do not claim that any of these cases are yet cured, but simply state the results.

In all our cases, the coagulation time (estimated by Wright's method) has been over two minutes. It will be seen from this table that the cases which have done best are those in which the general nutrition is good, and in which the disease is not producing any marked effect on the general health, as shown by blood changes, etc.

We can confidently state that, in every case except one, the reduction of cough has been a most noticeable event, and this has been accompanied by great diminution in the quantity of sputum. This improvement has been much more marked than in the cases formerly treated in this institution without injection of tuberculin. Sweating has only occurred in two cases, both of which died. There is also a general improvement both in the mental condition and appetite.

The physical signs in all cases tend to be less crepitant, and to be drier and more blowing in character. The sputum loses its purulent character, and becomes mononuclear in type. The bacilli also become less numerous.

Of the eight cases, which are marked satisfactory, three which have been treated for three months, four and a half months, and four months respectively, now have no crepitations; in two no bacilli are to be detected, while in the third, bacilli are not present in each examination. Of the remaining five, treated respectively eight months, nine months, eight months, five months, nine months, crepitations have much diminished, and the breath sounds over the affected area are blowing in character. Bacilli are much fewer in number, but can be found in all five. Seven of these eight are above their normal weight, while the remaining one is 97 per cent. of her normal average weight. In all the temperature has become normal, the pulse remains below 100, and menstruation has been regular. The colour indices have tended to rise, the red blood corpuscles to remain within normal limits, and the leucocytes to diminish. In these eight cases, there have been 11 auto-inoculations as shown by the index, and the general tendency of the index is to be low as compared with the other cases. A good reaction has immediately followed the injections. Among these cases there is one with laryngeal tuberculosis, on which Dr. Lack pronounces a satisfactory progress.

Of the doubtful cases, four in number, one, with marked signs of thickened pleura, went out of her own accord against advice, after three months' treatment, improved in every way—increase of weight, diminished crepitations and cough; but since returning to her home has got worse, with loss of weight and increased cough. The second case, treated for eight months, had an empyema scar with thickened pleura, etc. The physical signs of tuberculosis which were at the opposite apex have dried up, cough occurs only in the morning, but many bacilli are present. The third case, treated for eight months, had, at the right apex, a lesion which was recent. This has cleared to a large extent, but there was, at Christmas time, a spread to the right lower lobe which is now resolving. There is no expectoration, and she has gone up to 109 per cent. of her weight. The fourth case, treated for eight months, is interesting in that she had little expectoration, the physical signs have dried up and bacilli are fewer in number. But she is steadily losing weight. She has a hypertrophic tnberculous larynx and coughs a little. The temperature, after being raised for six months, came down to normal; she only menstruated twice during this time.

Ten auto-inoculations have occurred in these four patients. The general tendency of the opsonic index is to be normal or above normal, and is not much raised by injections in two, but rises quickly in the other two. In the first three, menstruation was regular, the temperature was normal, and the pulse was below 100. The colour index rose, red blood corpuscles remained normal, the leucocytes diminished in numbers. In two of these three, the weight is below 90 per cent. of the average.

As to the four cases which have done unsatisfactorily, all have lost weight, and the pulse rate has been over 100 per minute.

Case 1 had been in a sanatorium and had been discharged worse than on admission. Sweating was severe, the larynx was affected, and there was cystitis (B. coli). Cough was continuous and incessant, with much expectoration. The cough diminished, but neither expectoration nor any of her other symptoms or signs were at all improved. The cystitis could not be got rid of by the usual treatment aided by B. coli vaccine. She remained in three months.

Case 2 had three lobes and the larynx affected. There was evidence of old hip joint disease. The moist sounds in the lungs diminished, and the larnyx had healed. She was home-sick and lost weight, and decided to go home, and is getting worse. She was treated for two and a half months.

Cases 3 and 4 are aged 16 and 17, but look younger. One has numerous glands which have become smaller, harder, and more discrete. The right apex has cleared, but the left has become affected. In the other patient, the disease has spread to both upper lobes, originating in the right lower. Lately there has, in addition, developed a non-tuberculous empyema, which is now being treated. Both have lost weight considerably. The duration of treatment is eight months.

In these four, 11 auto-inoculations have occurred. The index has tended to be about or above normal, and a quick rise has followed inoculation. The pulse ranges from 90 to 135, being generally over 100. The colour index tends to rise, and the red blood corpuscles to fall in numbers. The leucocytes show less diminution than in the other groups.

Of the four cases which died, the first was admitted with the whole of the left lower lobe solid, and this gradually broke down, the rest of both lungs being involved. The second case died of hæmoptysis, but had not been doing well previously to this, the disease spreading. One of the remaining two had a mass of glands in the inguinal region, and the pulmonary lesion showed signs of excavation, whilst the other case had, post-mortem, extensive intestinal ulceration. The lungs showed a considerable number of caseous nodules.

In these four, treated for three months, two months, three months, and two and a half months respectively, a considerable degree of temperature was present, the pulse was always over 100, and the colour index, red blood corpuscles, and leucocytes all tended to diminish; menstruation was absent. Eleven auto-inoculations occurred. The index tended to be constantly above normal, and a slow rise followed inoculation.

We have to add a summary of four other cases not treated in the hospital.

Case 1, a doctor's wife, had been treated for four or more years, at intervals, in various sanatoria. She was able to go

about comfortably, but was inconvenienced by having to carry and use a sputum bottle. Physical examination suggested fibrosis with numerous small vomicæ and crepitations, especially over the lower lobes. The expectoration contained numerous bacilli. After 18 months' treatment the cough and sputum had disappeared, and the crepitations were no longer heard. In the past 14 months there has been no relapse of any kind. Tubercle bacilli, which had been very abundant, disappeared before the cessation of expectoration.

Case 2 had been treated for six months at St. John and Elizabeth's Hospital, had only slight temperature, but a fair number of crepitations in the left axilla and about two ounces of expectoration in twenty-four hours. The family history was very bad. She went out with increase of weight, but no alteration of physical signs. Six months later, injections were commenced, and after three months, physical signs had disappeared and there was no expectoration. No relapse has occurred in the three months following discontinuance of the treatment.

Case 3, a business man, who had also been under sanatorium treatment, and was tired of an idle life, has been injected for eighteen months. He has during this time been attending to his business in the city, and spending the rest of his time in the open air. The sputum has diminished, he has gained weight, and his physical signs are steadily diminishing, tubercle bacilli being much fewer.

Case 4, an undersized girl, began with a tuberculous ulcer of the tonsil, and also had consolidation of the left upper lobe with a cavity near the axilla. She was in the best possible position for home open-air treatment. The tonsil healed in less than three months and she improved till she contracted a typical attack of influenza (the patient being the last one in the household to be affected), after which the lower lobe was consolidated and broke down. The treatment was continued, the moist sounds cleared, and dry bronchial breathing is now only to be heard. But, in spite of this improvement, she is doing very badly, is losing weight, and there is no hope of a recovery.

Three of these four cases have done well, but one very badly.

Three other cases have been treated, but for a period of less than three months. In one, an old standing case with signs all over the chest, the sputum diminished and cough was less, and the moist sounds lessened, but death occurred six weeks after the commencement of treatment. The other two are showing much improvement in cough, sputum, and physical signs.

This is a small number of cases, and the results obtained do not carry great conviction. There has, however, been no selection of cases. We are convinced that the cough, expectoration, and contained tubercle bacilli are diminished much more than without injections, and that lesions, where crepitations predominate, tend to dry up and to be replaced by harsh and bronchial breathing.

The cases which have done best are those which presented the following conditions :—good physical state as shown by the relationship of weight and height, absence of temperature, after the first fourteen days, pulse below 100 per minute, moderately low blood pressure, regular menstruation, a colour index 0·8 or over. Red blood corpuscles 4·5 millions or more, leucocytes less than 15,000 per c.m.m. and an opsonic index, which has a tendency to be on the average below normal and to react sharply to inoculation, and the greater the departure from this standard the less favourable has been the case for this treatment. Lesions of other parts of the body are also unfavourable.

We have detected a spread of physical signs on five occasions about fourteen days after an auto-inoculation, but in the majority of cases of auto-inoculation we have, as might be expected, failed to discover fresh physical signs.

All our cases have shown evidence of auto-inoculation on admission, and we have two types of curves, (*a*) where the index is low on admission but rises and falls again in the course of 14 days, (*b*) where the index is high on admission but falls within 10 days. For this reason we delay giving the first inoculation till the patient has been in hospital for 10 or 14 days. The inoculation is best given when the estimation shows that the index has fallen to normal or below. If it is given when the index is falling but above normal, there is a tendency for the index to remain below normal and some difficulty is experienced in sending it up

again. In only one case has any general or local discomfort been complained of after an injection. This was in the case of the patient with inguinal glands, who died. The glands were more tender on the third or fourth days following the injection. We have not noticed alterations in the physical signs following an inoculation, nor that physical examination has given rise to a marked auto-inoculation.

Auto-inoculation has usually been synchronous with some increased physical effort, and has been accompanied, as Dr. Paterson[3] points out, with headache, anorexia, limb pains, and rise of temperature.

The intervals between injections has generally been 14 days, but in some cases 17, and in others 10 days, while two cases had to be injected every week to maintain a high index. As improvement occurs, there is a tendency to find less rise and fall in the index, and for the average to be nearer to the normal.

We have not been able to obtain any indications of the variations of the opsonic index by clinical observations.

In only three cases have we found it necessary to inject vaccines from organisms other than tubercle, in two cases where there was a B. coli infection of the urine, and the third case in which staphylococci were very numerous in the sputum. This produced a satisfactory result; of the two B. coli cases, in one the infection disappeared, and in the second a good result was not obtained.

We have not the least hesitation in saying that the results, obtained in these cases, in which tuberculin inoculations have been employed, are incomparably better than those without such vaccination, and we consider a continuance in this line of treatment well worth the extra trouble. Calvert[4] has also published encouraging results. It must however be clearly understood that vaccination is not to be regarded as a substitute for general treatment, but merely as accessory to it.

In conclusion, we would remark that the pulmonary lesions, whether tuberculous or not, which are most likely to benefit by injections of vaccines, are those in which consolidation is the predominant feature, and where excavation and bronchial dilatation are not marked features. Chronicity is not essential, but providing the lesion is not too extensive, is a favourable

incident. This accords with the experimental evidence we brought forward at the commencement of this article. In some of our cases, examination shows a considerable degree of inclusion of bacilli or cocci by the leucocytes and alveolar cells, and this has been coincident with general improvement.

This occurrence has been pointed out by Löwenstein [5] as a favourable prognostic indication. In several of our cases, in which improvement was taking place, we have noticed an increase in the average size of the mononuclear cells which we take to indicate a decreased activity in multiplication of the alveolar cells.

It remains to be seen whether the frequent inoculations, with increasing doses of vaccine, as practised by Trudeau [6] give better results than the system of small doses with longer intervals. Paterson's results of graduated labour suggest the advisability of small doses frequently; we are proposing to apply this therapeutically, at the same time watching the general effect on the patient, and the effect on the opsonic index.

We must express our thanks and great indebtedness to Sister Stanislaus for the attention and help she has given in this investigation.

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A SURGICAL VIEW OF THE OPSONIC METHOD.

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In the early days of the opsonic theory, I was strongly, and not altogether pleasurably, attracted to it by the results of its application to some of my cases. For example, a man and a boy, both suffering from gangreme of the appendix, were admitted one afternoon, and I prophesied that the man would be taken and the boy would be left. Our laboratory colleagues, with equal rashness, foretold that the man would live and the boy would die, and their forecast was fulfilled. They had found that the serum of the man gave a good phagocytosis to mixtures of coli bacilli, while, in the boy's serum, phagocytes were almost inert to the same organisms.

So the bacteriologists began to upset my conjectures. A case of disintegration of the kidney, which I thought to be tuberculous, was declared not be so, because the index to tubercle was persistently normal. It proved to be carcinoma of the renal pelvis. A case of peritoneal effusion was thought to be tuberculous, but fluid drawn off being normal in the opsonic property in regard to tubercle, the diagnosis was disputed. At the post-mortem, miliary carcinoma was found.

A symmetrical hydrops of the knee-joints in a child was thought by me to be syphilitic, but the application of an Esmarch's band so disturbed the opsonic index, that the diagnosis of tubercle was proclaimed by our positive friends, and was upheld by the subsequent course of the case. In another case, a diagnosis of tuberculous disease of the knee was correctly negatived, and there was almost certainly a sprain and nothing more. An enlarged knee-joint, very puzzling at the time, gave, after massage, an enormous index rise to gonococcus, and under observation its gonorrhœal nature was disclosed. These instances might be multiplied, but in place of a detailed confession, I admit that in cases in dispute I have perhaps never been the victor.

I do not imagine that any, who have been ward clerks, doubt the truth of the facts upon which the opsonic theory is based, but it is necessary for us to realise that, in dealing with this subtle thing, an opsonin—if it be a material—no such accuracy as chemists possess is yet obtainable. This serious truth is shown by figures which were obtained in the following way.

The blood of a sufferer from tuberculous cystitis, whose index taken through many months had usually proved to be low, was drawn into capsules and distributed to various laboratories where this kind of work is carried out. Eleven specimens were sent to ten laboratories, and the results returned were ·84, ·87, ·79, ·87, ·94, 1·09, 1·04, 1·07, 1·10, 1·13, 1·7.

One may remark that the first four results were obtained by workers, who had been trained in the same laboratory, and that the last figure was given by a worker in a laboratory in which the opsonic theory is discredited.

Does a vaccine in suitable cases and in suitable doses raise the opsonic index to the organism concerned? It hardly seems necessary to raise the question, but, as it is disputed by some, I have looked over the inoculation cards of 20 recent consecutive cases of tuberculosis, which show that the 55 inoculations were followed by a rise in the index in 49 observations, and I am sure that where daily observations have been made in my cases a rise has been observed in practically all, having its maximum from the fourth day to the seventh. This result is liable to be upset by disturbance of the focus by movement, massage, the employment of Bier's, or Klapp's method of congestion, and by operations.

But does a rise from a low to a normal opsonic index signify improvement? It certainly occurs in all cases which completely recover, and a stable normal index has never been found in any of my cases in which the disease has persisted, so that a continually normal index appears to be the best indication that a cure has been effected.

In tuberculosis an index chart, with high maxima and low minima, has, in my experience, been always of serious import.

When one wishes to judge the value of tuberculin in the treatment of surgical cases, one must remember that a large

majority of them reach a natural cure without its employment, more than half of them without abscess formation, and many of them without recognisable crippling or disability. It is impossible then to place reliance upon observation of a few cases. But if one finds in a long series of cases—amounting in my practice to 150 or more—that the course run in the cases has been uniformly more smooth, that except where, at the commencement of this treatment, there has been reason to suspect caseation or liquefaction of dead tissue, or in the case of bone sequestrum, no abscess formation has subsequently shown itself, nor have other foci developed, then surely one is justified in allowing some credit to this treatment. The thorough investigation of each patient at its commencement, and particularly the employment of X-ray pictures in the case of bone or joint will subsequently save much disappointment.

I have never been able to assure myself of the complete cure of glands thought to be caseous. I have seen them become much smaller, and it has seemed to me that the shrinking was of the living tissue and that the dead material was not got rid of. On reflection it seems to be too much to hope that protective substances and leucocytes can effectually penetrate and destroy the organisms of large necrotic masses, at any rate in the course of a few months or even years. Moreover, I have never seen a perfect scar in any tuberculous glands which I have removed, some remains of the cheesy mass or calcified material have always been present.

I do, therefore, recommend the removal of all tuberculous glands in which caseation is suspected, if practicable, and the chief use of tuberculin in such cases is perhaps to save the patient from repetition of this trouble. It is of immense service in operation cases, in which there is much breaking down of glands and infection of surrounding connective tissue, and the brawny swelling and stretched scar, perhaps keloid in appearance, with obstinately persistent sinus, common formerly, have not been seen in any cases so treated.

Open tuberculous lesions are so often infected by other pathogenic organisms that one must not omit mention of the splendid results obtained by inoculations directed to their

extermination, and several of my cases have by this means been rescued from death.

One is sometimes asked whether one should choose for operation a period of low or of high index. Unless a low index signifies a serious negative phase—and one can usually guess this by the condition of the patient—it seems to be the better period, since an operation has much the same effect as a large inoculation.

From what I have said, it will be gathered that I consider the opsonic index extremely valuable in guiding one to the indications for employing a vaccine, in gauging the dose, and repeating it at suitable intervals. My experience of the exhibition of vaccines without opsonic control is very limited, and so unhappy that I cannot bring myself to increase it, so long as I have the ungrudging help of our investigators.

It does appear, however, that, if sufficiently small doses are employed, harm is unlikely to attend the use of tuberculin in tuberculosis and, in cases in which the effect upon the index has been watched for a month or two, frequent observations of the serum are not necessary.

There is one point upon which, in conclusion, an opinion may perhaps be expressed. It is, that to do the best for our patients, we must be clinically associated with the opsonists. Their intelligent collaboration cannot be expected if their work is confined to the laboratory. Upon those, who may intend to follow this specialty, I would urge the importance of wide clinical study, which will enormously add to their usefulness, and enable them to escape from the danger of bigotry, and the tendency to belittle the efforts of those in other branches of practice.

ON THE TREATMENT OF SKIN DISEASES BY INOCULATION AFTER THE OPSONIC METHOD.

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THE method of treatment of infective diseases by means of appropriate inoculations, introduced by Sir A. E. Wright, has now been on trial for three years, and although it is perhaps still too early to give a decided opinion on the place it is likely to take in practical therapeutics, sufficient evidence is now in our hands to allow certain conclusions to be drawn.

For practical purposes, we may limit the discussion to the treatment of staphylococcic and tubercular skin affections. It is true that the streptococcus enters somewhat largely into the production of skin diseases, but the streptococcic diseases are either of so superficial a nature, as impetigo contagiosa, as to render simple local antiseptic treatment efficient, or they are so deep, as in the chronic relapsing lymphangitis, that it is difficult or impossible to obtain the organism in culture from the particular case, and it must be always borne in mind that, in the case of the streptococcus, it is all important that the vaccine used should be derived from the patient's own particular strain of organism.

The staphylococcic infections of the skin may be divided into primary, namely, boils, carbuncles, and sycosis, and secondary, such as are found in chronic septic eczema, in acne, and in septic ulcers. I have treated a considerable number of the primary affections, and may say, at once, that I have obtained amelioration in every case.

Boils, especially those which are coming out successively, and scattered over the whole body, offer the greatest opportunity for successful treatment. It is to be remembered that, where a patient has continuously recurrent boils over a comparatively small area, such as the back of the neck, there is usually some local exciting cause to be found, and, with the removal of this, and the application of mild inhibitory applications, sufficient to prevent renewed infection by the discharge

from boils already present, one may often bring about a cure with no further trouble. On the other hand, in those instances of general furunculosis, where boils are appearing first in one place and then in another, no treatment, prior to the introduction of Wright's method, has ever proved of the slightest use in my hands. As an exception to this statement, I may mention those cases, in which it has been possible to identify the cause of the trouble as connected with defective drains in the dwelling-house. In all the cases of furunculosis, which I have treated, I have obtained complete, and up to the present, durable success. In a large majority of cases, no further boil has developed after the commencement of treatment, but, in a few, a boil has occurred almost at the beginning, and, in one case, a boil developed after about four weeks' treatment, nevertheless this case ultimately gave an excellent result which has been so far maintained. In no case of boils have I found it necessary to give more than eight inoculations, that is, a treatment lasting about twelve weeks.

In sycosis, the case is slightly different. The long duration of the disease has apparently seriously modified the local condition of the skin, and the position of the organism, shut off as it is from the general tissues by the epithelial barrier of the external rootsheath, renders treatment more difficult. In every case which I have treated, however, I have been able to effect a considerable amount of improvement, and in those cases, in which the inoculation has been combined with a temporary depilation, by means of the X-rays, the results have been very gratifying, and far better than those in which the rays have been used alone. At the same time, I have seen relapse take place, even after the combined treatment, and especially has this been the case where the disease has been localised in the upper lip, and the patient has been a sufferer from discharge from the nose.

I have little doubt that, in order to obtain a permanent cure, one must see to it that any source of local irritation, such as the nasal discharge already mentioned, or the constant exposure to an irritating dust, as is the case with colliers and cement workers, must be removed, and also that one must be prepared to carry on the treatment for a far longer period than is necessary in the case of boils. With these two provisoes, I

consider that the inoculation method is a great advance in the treatment of sycosis.

Of the secondary infections, acne is probably that which most commonly comes under consideration. It is, in my experience, much more difficult to offer a decided opinion on the value of the treatment in this disease.

Acne is an extremely polymorphic disease, and, although one may consider all varieties of acne vulgaris to be part of the same process, yet the varying predominance of the different factors is of great importance in relation to the opsonic treatment. For the purpose of analysis, the cases of acne may be classified into three groups:—(1) The class in which oily seborrhœa is very marked, comedo abundant, and suppuration exceptional. (2) That in which oily seborrhœa is not extremely marked, the comedo is slight and easily overlooked, but suppuration is present in the form of numerous superficial pustules lasting a short time and leaving no obvious scar after disappearance. (3) That in which oily seborrhœa is marked, comedo variable, but suppuration occurs in the form of deep nodose swellings, which run a very indolent and prolonged course, often leaving chronic thickenings which may inflame again and again, and usually cause deep and disfiguring scars when they finally resolve. This is the form which is sometimes known as acne indurata.

I have treated a fair number of the first class of case, and have not found that the inoculation treatment alone is of any great value. While actually under treatment the tendency to suppuration becomes perhaps less, but the cases relapse immediately on its cessation. This is scarcely to be wondered at when we consider that the comedo is a secondary product of the oily seborrhœa, and has nothing to do with staphylococcic infection, being due, in my opinion, to the growth of the microbacillus in the neck of the pilo-sebaceous follicle. I have not found in any of my cases that the persistent treatment with staphylococcic vaccine has any effect in causing the extrusion of existing, or preventing the formation of new comedones. These cases, on the other hand, usually yield to ordinary therapeutic measures, both local and general, directed against the seborrhœa, combined with mechanical or other treatment, designed to remove existing comedo.

In class (2), with the superficial pustules, my results have been surprisingly good. From the aspect of the skin one would imagine that brisk antiseptic treatment would be sufficient to clear up such a slight disturbance, but this is, in my experience, by no means always the case. On the other hand, I have sometimes found almost every lesion disappear, and the process become arrested even after the first inoculation.

In class (3), the indurated variety, one has to deal with a disease which is obviously resistant, and so deep-seated as to be with difficulty, if at all, reached by antiseptics applied to the surface. There is usually, if not always, some defect in the general health, most often connected with the alimentary canal. In order to treat these cases successfully by means of the opsonic method, it is advisable to cultivate the organism from the lesion on the patient's skin, and to use this as a means of making a vaccine. I may say that it is my practice to do this in all private cases of acne, and that, in one of the worst cases of acne indurata, in which I was unable to cultivate the organism in sufficient numbers to make a vaccine, even after repeated attempts, my efforts to improve the condition were quite unavailing. In all cases of indurated acne one must be prepared for a somewhat longer course of treatment than in the slighter forms. In no case have I given more than ten inoculations, but I have had some failures, and it is possible that, had I induced these patients to persevere for longer, a satisfactory result might have been obtained. Two cases of severe indurated acne present interesting features. One of these occurred in a young man, the subject of marked hyperidrosis, especially of the hands and feet, which were also almost always cold. In this case the opsonic index was low, between ·7 and ·8, and I had no difficulty in demonstrating staphylococci in the pus from his lesions, or in procuring a culture from which I made a vaccine. Although, after inoculation, his index was successfully raised, and maintained at a high level, very little, if any, benefit was observed. My own impression was that he showed no amelioration at all, but he himself thought that he suffered from severe bouts of the disease rather than from a continuously severe eruption. The treatment was, however, given up, as his father thought it was not of sufficient utility to make it worth further trial. The second case was that of

a lady, a little over 30, who had been the subject of extreme nodose acne for more than 10 years. The staphylococci were demonstrated in small numbers in the pus, but I could never get a free growth. On two occasions I succeeded in getting a feeble growth of a Gram-staining staphylococcus, which I could not distinguish from Staphylococcus pyogenes albus, but, on both occasions, it rapidly died out, so that I was unable to prepare a vaccine of her own strain of organism. The use of a stock vaccine raised her index to the organism, from which the vaccine was prepared, but no corresponding clinical improvement was observed, and the treatment was therefore given up.

In some cases of chronic septic eczema, and in septic ulcers, I have been able to procure extremely gratifying results, but failures have been not uncommon.

Turning to tuberculosis, we may classify the cases under the heading of Lupus vulgaris, Scrofulodermia, and the Tuberculides. I may say at once that, in Lupus vulgaris, my results have been very disappointing. I have had several cases under careful observation and treatment for over two years. In no case did the disease spread under treatment, where the method was carried out efficiently. In one case, the patient, a small boy, belonged to an extremely poverty-stricken family, and I was never able to raise his index, while, in another, the patient could come only at long intervals, and both of these cases went downhill under treatment.

In one case, fairly marked amelioration was produced, but in over two years no prospect of a cure was obtained, and he finally went elsewhere for light treatment, which I believe is acting satisfactorily. All other cases remained practically stationary, with perhaps the slightest improvement, except one who is still under treatment. In this case, a boy, aged eight, the lupus is confined to a small patch about half an inch in diameter on the right cheek. I should not have thought it justifiable, in such a case, to use the opsonic method, but should have immediately excised the patch, had it not been that he had very extensive tuberculous adenitis of both sides of the neck as well. I therefore thought that I might try inoculation for both types of lesion together, more especially as his mother is extremely trustworthy, and brings

him up to the hospital very regularly, so that if there is the slightest sign of spread I can remove it at any time. This case has been under treatment for only a month or two, and is apparently improving slowly as regards the lupus, and more rapidly as regards the glands. I have treated several cases of scrofulodermatous ulcers, the result of burst tubercular glands, and they have done well, though, in some cases, the surroundings have been as adverse as one could well conceive. Two cases of Bazin's disease have been treated, one of which has apparently completely recovered, while the other, after improving enormously at first, relapsed, and then seemed to derive very little further benefit from the treatment.

Conclusions.—I may thus sum up my results as follows :—

In generalised furunculosis, the opsonic method surpasses all others.

In sycosis, the treatment is tedious alone in well-established cases. In commencing cases, cure is immediate, and, in old cases, combined with X-rays, it is quicker than the rays alone, and far preferable to the older forms of treatment.

In acne, the results are very variable, but I have obtained cures in many cases which have defied the older methods.

As regards tuberculosis, it is of value in those forms in which there is ulceration, but in my experience the results in lupus have not been such as to bring it into serious competition with the light treatment for advanced, or excision for circumscribed cases.

THE TREATMENT OF LUPUS AND TUBERCULOUS DISEASE OF THE EAR, NOSE, AND THROAT BY INOCULATION.

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The contributions to literature, with regard to the value of a tubercle vaccine in lupus and tuberculous disease of the ear, nose, and throat, have been comparatively few in number. This probably is partly due to the fact that tuberculous lesions of these regions are frequently associated with the more serious pulmonary complications of tubercular origin, so that, in the majority of cases, it probably has not been deemed advisable to attempt this form of treatment.

To test accurately and scientifically the value of the treatment of tuberculin in these cases, an absolute diagnosis should first be made before the treatment is actually begun, and the specific organism causing the disease should, if possible, be demonstrated. Further, during the period of the experiment, the case should not undergo any other form of treatment. It will, however, be obvious that, in dealing with human subjects, it is seldom possible to fulfil these conditions. For instance, in lupus or tuberculous disease of the nasal or naso-pharyngeal mucous membranes, it is not always possible to demonstrate the tubercle bacillus, and, in such cases, as in the series recorded below, the diagnosis usually has to be made from a consideration of the clinical features presented, and from observing the effect of treatment. It should also be noted that, in the majority of our cases, previous treatment has already been resorted to, in some instances, for periods extending to several years. Such previous treatment included curetting of the interior of the nose, in cases of lupus of the nasal mucous membrane, the local application of the cautery and caustics, or of the X-ray light, or the giving of iron and arsenic internally.

Although, indeed, theoretically many factors are present in our cases which may prevent an accurate estimation of the true value of the treatment by tuberculin, yet, from a practical point of view, this does not lessen the importance of our observations, as it brings out into strong relief those cases in which benefit was obtained after other treatment had failed, and at the same time does not mask the instances in which the value of inoculation was not very great. It should further be noted that the cases we have had under treatment have been dealt with entirely as out-patients, and consequently could only be seen at intervals varying from one to three weeks, according to the distance of their homes from the hospital, thus making a frequent examination of the blood impossible.

Case 1 (A.B.), October 1906. A girl, aged nine months, suffering from tuberculous disease of the right ear.

A middle ear suppuration had existed since the third month after birth, and had continued intermittently ever since. There was a slight offensive discharge, irritating in character, so as to cause eczema of the auricle. The tympanic cavity was filled with friable granulations, and with the probe carious bone could be felt in the region of the attic and antrum. The pre-auricular and upper cervical glands were enlarged, and, in the posterior triangular of the neck, two had broken down, and were discharging on to the surface by sinuses. The child was pale and in a feeble state of health. There was a strong family history of tuberculous disease. Clinically, the case was diagnosed as tuberculous disease of the middle ear.

Treatment.—The granulations were removed from the ear by means of the curette, and at the same time the sinuses in the neck were freely scraped. A microscopic examination of sections of tissue removed showed the presence of giant-celled formation; but no tubercle bacilli were found. In spite of aseptic conservative treatment no improvement took place. As granulations re-formed within the tympanic cavity, the advisability of performing the complete mastoid operation was considered, but it was eventually decided to see whether any benefit could first be obtained from the use of vaccines.

With regard to inoculation treatment, the first point to

determine, in this case, was whether the lesion of the middle ear, together with the secondary involvement of the lymphatic glands, was due to a primary infection with the tubercle bacillus, or a pyogenic micro-organism. In favour of the latter, was the fact that pus cultures taken from the sinuses in the neck grew staphylococcus aureus in pure culture.

In order to answer this question, the opsonic index was estimated both for the tubercle bacillus and for the staphylococcus aureus. The indices arrived at were tubercle bacillus ·56, staphylococcus aureus 1·0. This was repeated on two other occasions with similar results. It was considered, therefore, that the clinical diagnosis in all probability was correct, and that treatment with a tubercle vaccine was indicated. The first injection given was $\frac{1}{15000}$ mgr. of tuberculin (T.R.).[1] This was followed by a rise in the index to 1·03; in ten days, however, it had again fallen to ·5. The same dose was therefore repeated and was followed by a rise of 1·2. Four weeks later, the discharge had considerably diminished, and the glands had become more discrete and movable. After two months' treatment, the discharge from the ear had ceased, but still continued to a slight extent from the sinuses in the neck. A staphylococcus vaccine was therefore used alternately with tuberculin, with the result that the sinuses completely closed, and the glands showed more rapid diminution in size until they entirely disappeared. The disease in the tympanic cavity was also arrested, the granulations disappearing and the discharge ceasing. The inner wall of the middle ear is now lined with scar tissue, and a dry fistula, extending into the region of the attic and antrum, exists as evidence of the previous bone disease.

Remarks.—The diagnosis of tuberculous disease was made from the clinical features of the case, and was confirmed by the result of the examination of the blood. The opsonic index, which, before treatment, was very low, rapidly rose in response to the inoculations; and this rise in the index was accompanied by a rapid improvement both in the local and general condition.

[1] The dosage of tuberculin given throughout this paper is measured on the assumption that one cubic centimetre contains two milligrams of the dried solid substance.

Case 2. (C.D.).—Youth, aged 20. Tuberculous disease of both ears.

The patient was examined on November 24th, 1906. A slight pulmonary phthisis of the apex of the left lung had existed for a considerable period, but was now quiescent, and the general condition was good. Six weeks previous to coming under observation, there had been ear-ache in the left ear for a few days, followed by a slight discharge; and for two weeks there had also been discharge from the right ear. Since the onset of the ear trouble, there had been practically no pain, the chief symptom being a rapidly increasing deafness. Examination of the left ear showed the tympanic cavity to be filled with friable granulations. On the right side there was a small perforation; on probing the tympanic membrane, which was pale and bulging, there was a feeling of resistance as if the tympanic cavity was filled with a soft mass (? tuberculous infiltration of the mucous membrane). Tuning-fork tests gave marked diminution of bone conduction and impairment of hearing for high tuning forks, showing that the deafness was partly due to changes having already taken place within the internal ear.

Tuberculous disease of the middle ear was diagnosed, and microscopic examination of some of the granulations, removed by the curette from the left ear, proved the presence of tubercular nodules containing giant cells and tubercle bacilli. The question of the mastoid operation was discussed, but, as both ears were involved, and as the parents objected very strongly to any operative procedure, it was thought expedient to try inoculation treatment.

On commencing the inoculations, the patient had an index of ·87. Doses of $\frac{1}{10000}$ were given, aud the index was raised by the first injection to 1·14 and by the second to 1·5. At the end of January 1907 an acute dry pleurisy occurred. No injection had been given for twelve days, but, as the index had fallen to ·9, an injection was posted to the doctor in charge of the case. This was crossed by a letter to say that the patient had an attack of pyrexia, probably influenzal. The injection was therefore withheld. Two days later the index was ·6 and a pleuritic rub developed. It was considered that, in all probability, an auto-inoculation had occurred, and further

inoculations were therefore temporarily withheld. This proved to be the case, the index rising to 1·8 within the following fourteen days. When it fell again inoculations were resumed, and were continued until the end of June 1907. This patient volunteered the information that his hearing improved greatly after each injection, and deteriorated again if a long interval was given before the next injection. The discharge from the ears diminished in amount soon after the injections were commenced, and increased again during the attack of pleurisy. When inoculations were recommenced, the discharge again diminished and has now entirely ceased. In general health the improvement has been very marked, and the gain in weight has been considerable.

The local treatment to the ears consisted in occasionally syringing them with a mild antiseptic lotion, afterwards drying them, and puffing in some powder. Unfortunately, an opportunity was never given to re-examine the ears, but a report dated July 19th 1907, from the doctor, says: "he was much better in his general condition, and had lost all temperature; his ears had ceased discharging, but he was still somewhat deaf."

Case 3. (E. F.).—Tuberculous disease of the middle ear on the right side, in a child aged four.

In October 1905, the patient was being treated by a surgical colleague for tuberculous disease of the tibia, the bone having to be scraped on several occasions. In spite of treatment several sinuses still existed at the head of tibia.

In March 1906, the child was admitted as an in-patient in order to have the complete mastoid operation performed on the right side. There was an offensive sanious discharge from the ear, which was partly filled with friable granulations; and with a probe carious bone could be felt. There was also slight enlargement of the upper cervical glands and facial paralysis. The child was very anæmic and unhealthy looking. The case was diagnosed, clinically, as tuberculous disease of the middle ear. On performing the complete mastoid operation, the mastoid process was found to be extensively diseased; large fragments of carious bone could be scraped away, and the whole mastoid process was filled with gelatinous-looking granulations. The posterior wound was left open, and was dressed daily.

The wound healed very slowly, and exuberant granulations had to be curetted away repeatedly. In October 1906 (one year later), inoculation treatment was advised in the hope of aiding the after treatment.

Before treatment commenced, the opsonic index was ·8. An initial dose of $\frac{1}{15000}$ mgr. caused a rise to 1·34, followed by a decline again to ·85. Inoculations were then given every two or three weeks, the dose varying from $\frac{1}{15000}$ to $\frac{1}{10000}$ mgr. By the end of January 1907, the sinuses in the leg had ceased to discharge, and the glands in the neck were very much smaller. In August of the same year the glands were no longer palpable.

Remarks.—As a result, therefore, of inoculation treatment, there was great improvement, not only of the ear but of the tibia. The wound behind the ear had now completely healed. There is still facial paralysis, but no longer any enlargement of the glands. The sinuses in the tibia have also healed. The mother is convinced that the improvement dates since the inoculations were begun.

Case 4. (G. H.)—Man aged 44. Lupus of hard and soft palate and of the fauces.

In 1901, a patch of lupus on the chin was cured after being twice curetted. In 1903, nodules were noticed on the uvula, which had become much enlarged. Although the patient was seen by two or three specialists, the diagnosis of lupus was at first doubtful. The disease gradually spread to the soft palate, which was then curetted, but with no obvious improvement. In 1904, as the condition had become worse, light treatment, under Dr. J. H. Sequeira, was tried for over a year. This was also ineffectual. No internal treatment, such as potassium iodide or arsenic, had ever been prescribed. In March 1905, he came under the care of one of us (H. T.) and punctate cauterisation of the palate and fauces was tried at intervals of two or three weeks. This, at first, did good. Suddenly there was a marked relapse, the lupus spreading rapidly over the soft and the posterior part of the hard palate, and along the fauces; at the same time, the recently cauterised areas became necrotic, and perforation of the soft palate seemed imminent. Inoculation treatment (which at this time had just been introduced at the London Hospital) was therefore advised.

This was commenced in December 1905. In December 1904, the patient had had his tuberculo-opsonic index estimated by Dr. W. Bulloch, who found it to be ·74 but no inoculations were given at that time. In December 1905, the opsonic index was found to be ·73. An initial injection of $\frac{1}{6000}$ mgr. was given and the index, eight days later, had risen to 1·0. Four days later ·88 was registered and another $\frac{1}{6000}$ mgr. was given. At the end of six weeks, after three injections had been given, the ulcers had entirely healed. The opsonic index was then kept up to 1·0 by occasional injections, for a period of five months. In July 1906, two small ulcers appeared on either side of the soft palate close to the anterior pillars of the fauces. The index was found to be ·95. Injections were again recommenced with the result that complete healing occurred within four weeks. Since then the patient has been kept under observation, and no further relapse has occurred.

Remarks.—It will be seen, therefore, that, as a result of the inoculation treatment, there was an extraordinarily rapid improvement, and that already, after the third injection, there was practically complete healing except for one or two small nodules. All traces of lupus disappeared within six weeks after the first injection. With this there was a general improvement in health. The cure was maintained for a considerable period, but one or two lupoid nodules returned owing to too great an interval being left between the inoculations. For the last twenty months there has been no recurrence, and the patient is still in good health.

This case, of which there is an accurate clinical record from the onset of the disease, is of great interest from two points of view:—(1) The success of inoculation treatment after failure of curetting, cauterising, and light treatment. (2) The recurrence of the disease as soon as the opsonic index became low. Immediately the inoculation treatment was renewed, healing took place rapidly, and, as a result of further inoculations, in order to retain a high opsonic index and good resisting power, no further recurrence has taken place.

Case 5. (I. J.)—Extensive lupus of the nose and throat in a woman.

The disease had existed for years, and involved the inferior turbinates, floor of the nose on both sides, the soft palate,

fauces, back of the tongue and pharynx, and also the epiglottis, epiglottic folds and ventricular bands of the larynx. The nose had been curetted twice, and arsenic had been given internally. Although treatment had caused improvement in the nasal condition, the throat remained unaffected.

Inoculations were given at intervals of three or four weeks for fifteen months, but with no apparent improvement, although the patient thought that she felt more comfortable. The opsonic index, when the patient first came under treatment, was 1·3, and varied from time to time between that point and ·63. This variation was probably due to auto-inoculation from the lungs, as both apices are involved.

Remarks.—As can be readily understood, unless auto-inoculation can be controlled, artificial inoculation becomes extremely difficult to carry out. Unfortunately, to control auto-inoculation in an out-patient is practically an impossibility. It is difficult in this case to say whether inoculation treatment in any way retarded the disease, but apparently it did no harm.

Case 6. (K. L.)—Youth, aged 21. Lupus of nose and face.

The disease began seven years ago with lupus of the face, auricle, tip of nose, and leg. The patches were curetted several times. At intervals, during the last five years, the patient has had the light treatment applied to the face, whilst the interior of the nose has been curetted three times within the last two years at intervals of six months. During this period, the patches on the face improved temporarily, but relapses invariably took place during the intervals of treatment, the disease never completely disappearing.

Inoculation treatment was begun in April 1907, the patient receiving six injections within five months. As the result of this inoculation treatment, the interior of the nose greatly improved, so that, although the patient came up to the hospital, in July 1907, for the purpose of being again curetted, this operation did not seem necessary. In addition, the general health of the patient has also very much improved, and the lupus has disappeared from the face.

Case 7. (M. N.)—A pale, weakly boy, aged 12, suffering from extensive lupus, which completely obstructed the nose, and also involved the hard and soft palate, fauces, pharynx, and epiglottis.

Owing to his intense anæmia and the extent of the disease, inoculation treatment was advised before any operative measures were attempted.

In June 1906, the opsonic index was found to be undergoing fluctuations between ·7 to 1·3. After a month, however, this steadied to ·8, and inoculations were then commenced. The initial dose was $\frac{1}{10000}$ mgr., and this was repeated at intervals indicated by the curve of the opsonic index. At first there was a marked tendency for the index to fall again, but an occasional injection is now sufficient to keep the resistance up to the normal line.

As a result of the inoculation treatment, there was at once considerable improvement of the general condition. The anæmia became less, and the body weight rapidly increased. At the same time, the lupus gradually disappeared from the hard and soft palate and pharynx. Eighteen months ago (three months after the beginning of the inoculation treatment), the interior of the nose was curetted. This greatly improved the nasal breathing. Further curetting of the nose was necessary a year ago. The lupus has now entirely disappeared from the hard and soft palate, and is limited to a slight thickening and to one or two nodules on the edge of the fauces. The epiglottis is much smaller. There is still slight lupus of the nose, but it does not seem progressive. The general health of the boy is excellent.

Case 8. (O. P.)—A woman, aged 40. Twenty-three years ago there was soreness and ulceration of the vestibule of the nose followed by perforation of the septum.

Eight years ago, the interior of the nose was curetted without much benefit. The patient came to the London Hospital six years ago for light treatment, but it could not be successfully applied within the nose. The interior of the nose was curetted by one of us (H. T.) five years ago, and again on two further occasions at intervals of a year, with considerable improvement.

Inoculation treatment was begun in November 1906. Before treatment was commenced, the opsonic index was estimated and found to be ·86. An initial dose of $\frac{1}{10000}$ mgr. was given, and the index rose to 1·5 but soon fell again to ·83. Similar doses have been repeated at intervals, and an

occasional injection is now sufficient to keep the index up to normal.

Remarks.—The mucous membrane of the nose is still pale and swollen (August 1907), and small patches of lupus can be seen at the back of the nose on both sides. The patient's impression is that the curetting of the nose did most good, and that no benefit was derived from the inoculation treatment. She is, however, in good health, and as there has been no necessity to curette the nose for over two years, it is only fair to suggest that the inoculation treatment, by maintaining the resisting power of the patient, has in this way tended to arrest the progress of the disease.

Case 9. (Q. R.)—Boy, age 12 years, with extensive lupus of the nose and palate, also involving the tip of the nose and upper lip.

The interior of the nose was curetted in January 1906, and he has also been under Dr. J. H. Sequeira for Finsen light treatment for the lupus on the face.

Inoculation treatment was commenced, in October 1906, when the opsonic index was ·9. After three months, considerable improvement was noticeable, but there was still much œdema of the upper lip and nose. He was therefore given calcium iodide grs. ii. t.d.s. with marked benefit. For the last four months, injections of $\frac{1}{15000}$ mgr. have been given at intervals of four weeks. This has been sufficient to keep his index above 1·0. Recently there has again been considerable improvement, but owing to other treatment having been adopted, it is difficult to say to what extent he has benefited from inoculation treatment.

From the series of cases referred to above we consider that the following conclusions may justly be drawn with regard to the value of treatment by tuberculin covered by the opsonic method.

(1) Inoculation treatment carried out with suitable dosage, and at suitable intervals, is not harmful. In no case was there any acute exacerbation of the disease resulting from an inoculation. In Case 2, in which there was an attack of dry pleurisy, presumably tuberculous, there is no evidence to suggest that the inoculations were in any way the cause of the outbreak.

(2) It would seem that in those cases, in which the index is low and the disease relatively acute (Cases 4 and 7), marked benefit may be expected from inoculations. On the other hand, if the index is not much depressed, and the condition is more chronic (Cases 5 and 8), inoculations by themselves are not sufficient to bring about a rapid cure.

We would suggest that the explanation of these facts lies in the question of the blood determination. In the more acute cases there is little local fibrosis, and, in consequence, the local circulation is good, and the protective bodies in the blood are able to reach the focus of infection. On the other hand, in the chronic cases, in which there is much fibrosis, it is not sufficient only to increase the protective bodies in the blood, but these elements of defence must be enabled to reach the infective organisms. This, it would seem, is the most difficult problem in the treatment of cases of lupus of the mucous membranes, as most of the ordinary methods of producing a local congestion are inapplicable.

(3) When possible we should suggest that inoculations should be given in conjunction with the surgical measures for removing the focus of the disease. No operation should be done unless the index is previously ascertained to be at or above the normal line. If the index is found to be low, inoculations should first be given, and operative treatment postponed, unless immediately urgent, until the resisting power is shown to be high.

(4) Examination of the blood may be of value as a means of diagnosis. For example, in Case 1, although the case, clinically, was diagnosed as tuberculous disease of the middle ear, no tubercle bacilli could be found, and there was a possibility that the symptoms might be due to pyogenic infection. The result of the blood examination, and the benefit derived by inoculations of tuberculin, confirmed the diagnosis already made.

ULCERATIVE ENDOCARDITIS AND ITS TREATMENT BY VACCINE-THERAPY.

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Until the microbic origin of rheumatic fever and of its attendant cardiac affections is more definitely proved than it is at present, the one intrinsic disease of the heart, which promises to be benefited by the application of the principles of vaccine-therapy, is ulcerative endocarditis. It would be sound treatment, in addition to the surgical procedures usually adopted in cases of pyopericardium, to inoculate the patient with appropriate doses of a killed culture of the micro-organism concerned. But of this use of bacterial vaccine I have as yet had no experience. Excepting this, vaccine-therapy is at present confined to the disease termed malignant, ulcerative, or infective endocarditis.

Every case of ulcerative endocarditis may be said to be a case of septicæmia ("arterial pyæmia"). This fact has led many physicians to express doubts that a patient, whose blood-stream is being constantly charged with bacteria, and who is therefore in a perpetual state of auto-inoculation, could possibly derive benefit from the artificial introduction of minute doses of killed micro-organisms. Against this attitude of mind two considerations might well be urged. A general consideration, that in our present state of ignorance of many essential facts concerning natural immunity no assumptions can safely be made. A special consideration, that in cases of ulcerative endocarditis the number of living micro-organisms present in the patient's blood is ofttimes strikingly disproportionate to the severity of the constitutional condition, suggesting that there is, for some reason or another, very little immunising response on the part of the tissues to the blood infection. Experience of blood-cultures in this disease has long ago dissipated the writer's preconceived notion that a quantitative estimation of the bacteria present in the circulation might be taken as a point of great prognostic value. The discovery of micro-organisms in the blood is, of course, a point of great

importance, both in diagnosis and in prognosis, but in regard to prognosis the virulence of the particular micro-organism isolated is of greater value still. Now the virulence of the bacteria present in the blood in the majority of cases of ulcerative endocarditis is of a low order—a point to which reference will be made. If this is so, and if, as already said, patients are not ill in proportion to the number of bacteria per cubic centimetre of their blood, it becomes evident that general assumptions concerning the degree of auto-inoculation taking place in this disease should not be made.

Latency of the Disease. Importance of Early Diagnosis.—The existence of large numbers of living bacteria in the blood without much associated disturbance of the patient's health, though not uncommon in ulcerative endocarditis, would seem to be confined to this disease. On this account the disease often remains latent and overlooked for weeks and sometimes for months. It is certain that patients suffering from the disease go into consulting rooms and hospitals, and out of them, without this state of things being suspected. The customary picture of the disease, painted in the pages of the medical text-books, and imaged in the mind of many doctors, is that of a fulminating process, attended by high fever and grave symptoms, and running a rapidly fatal course. For one such case, however, there are a dozen in which the onset is insidious and the course prolonged, although the end is equally fatal. The fever may be quite slight, with afebrile periods, or occasionally the disease may be afebrile throughout. As regards the duration of the disease, it may be anything from three days to three years : six to nine months is quite common. These considerations are bound up with the nature of the bacteria present in the infected endocardium, and are explained by the great differences in their virulence. Into the question of the frequency of occurrence of the disease I will not enter here. Suffice it to say that it is quite common ; how common only those observers really know who make a practice of cultivating the blood in all cases of valvular disease presenting unusual symptoms.

Nor am I concerned with the question of diagnosis. But inasmuch as the success of treatment must turn largely upon the establishment of an early diagnosis, it is all important that

the possibility of the disease should be kept constantly in mind. Given the existence of valvular disease, *no matter from what cause arising*, the presence of fever, some loss of flesh and colour, a few petechiæ in the skin, a retinal hæmorrhage, pain and swelling of a phalangeal joint, a tender spleen, these are a few of the danger-signals calling for a bacteriological examination of the blood. The technique of the blood-culture is important, and, if properly observed, a negative result may be taken to give a probability of over 90 per cent. against infection of the diseased endocardium.[1]

Nature of the Infective Element in Malignant Endocarditis.—Treatment of a case of ulcerative endocarditis on specific lines involves a knowledge of the nature of the infective element and its isolation from the blood-stream. The micro-organisms present in 28 consecutive cases of the disease in which the writer has obtained positive blood-cultures have been as follows :—

1. Streptococci in 18 cases.
2. B. influenzæ in 5 cases.
3. Pneumococci in 3 cases.
4. Gonococci in 1 case.
5. Staphylococci in 1 case.

It is seen that streptococci occur in over 65 per cent. of the cases. If the pneumococcus be regarded as a type of streptococcus then the percentage rises to over 77. The prevalence of Pfeiffer's bacillus, as a cause of malignant endocarditis, has been referred to by the writer elsewhere, in a communication dealing with the first two recorded instances of cultivation of the influenza bacillus from the blood. The relatively low position taken by staphylococci in the list above is due to the fact that the cases are drawn from medical and not from surgical sources. In cases of osteomyelitis, and some other surgical diseases in which malignant endocarditis is apt to develop, the commonest infecting agent is staphylococcus aureus.

The characters of the streptococci found in the blood during life, and in the blood and heart vegetations after death, in cases of malignant endocarditis, have been recently dealt with by

[1] An article by the writer on a method of performing blood-cultures appeared in THE PRACTITIONER for November 1905.

Andrewes and Horder. These authors showed that, by a study of the metabolic reactions yielded by various pathogenic streptococci in the manner suggested by M. H. Gordon (*Local Government Board's Report*, 1903–4), and by observing certain other features of these bacteria, they might be differentiated into the following types :—

Types of Streptococci.	Reactions with Gordon's nine tests.									Growth on Gelatin at 20° C.	Morphology in Broth.	Pathogenesis for Mouse.
	Milk clot.	Neutral red.	Saccharose.	Lactose.	Raffinose.	Inulin.	Salicin.	Coniferin	Mannite.			
1. S. Pyogenes -	.	.	+	+	.	.	±	.	.	+	Longus	+
2. S. Salivarius -	+	+	+	+	±	.	.	.	.	±	Brevis	.
3. S. Anginosus -	+	±	+	+	.	.	.	.	.	±	Longu	+
4 S. Fœcalis -	+	±	+	+	.	.	+	+	+	+	Brevis	.
5. Pneumococcus	±	.	+	+	+	±	.	.	.	.	Brevis	+

When the various strains of streptococci, isolated from cases of ulcerative endocarditis, are compared with these types, it is found that *by far the majority of them conform to the types S. salivarius and S. fœcalis*. The cases in which S. pyogenes is present are comparatively few and are usually rapidly fatal ; they constitute some of the fulminating cases already referred to as being less common than the more chronic cases. They are, moreover, prone to be terminal events in some acute or chronic streptococcal infection elsewhere in the body rather than direct infections of damaged heart valves.

The commonest micro-organisms causing malignant endocarditis, then, are comparatively non-virulent streptococci of the salivary and intestinal types ; identical, in fact, with the so-called "saprophytic" streptococci of the human alimentary canal, from which source they are undoubtedly derived. It now becomes clearer why they may exist in considerable numbers in the circulating blood without much evidence of auto-inoculation, or without necessarily giving rise to acute symptoms. They are not of sufficient virulence to evoke an effective reaction on the part of the tissues.

Treatment by Drugs and by Bactericidal Sera.—It is safe to say that until recently the septicæmia present in malignant endocarditis has resisted all efforts made to check its course.

Drugs reputed to have a germicidal effect in the blood, and substances known to possess the power of causing leucocytosis, have been tried over and over again. The writer has given steadily increasing doses of quinine, of arsenic, of mercurial salts, of sodium sulpho-carbolate, and of formalin, until very large doses were being taken. But without any good results.

Bactericidal sera have proved almost, if not quite, as ineffectual. Despite the occasional successes recorded by other observers, the writer has failed to convince himself that he has cured any patient suffering from ulcerative endocarditis, or has seen any such patient cured, *the diagnosis being proved by blood-culture*, by the most liberal use of bactericidal sera. In the absence of bacteriological proof of the nature of the disease, no records of cure are to be accepted as proved. Bearing in mind the fact that the type of streptococcus, usually present in ulcerative endocarditis, is not *S. pyogenes*, and that the market brands of anti-streptococcal serum are made by the use of various strains of *S. pyogenes*,[1] it must not be considered as proved that anti-sera are of no avail because the market sera prove useless. For a serum *specifically* prepared might act more beneficially. But in two cases of ulcerative endocarditis, where the writer has been able to get special sera prepared by injecting into horses the streptococcus isolated from the patient's blood, no good results followed. In one of these cases there was ample time to give the specific serum a very good trial, for the micro-organism was isolated more than four months before the patient's death, and the use of the serum was extended over several weeks. Such crucial tests as these dispose the writer to think that the use of anti-streptococcal serum in malignant endocarditis is quite useless. In the case of pneumococcus endocarditis, the writer has seen equally disappointing results from the use of Pané's serum.

Treatment by Specific Inoculation.—The introduction by Wright of the treatment of certain staphylococcal infections by the inoculation of killed cultures of the coccus causing the disease has opened up another possibility in the treat-

[1] It should be remembered that a "polyvalent" serum is a serum made by the use of *S. pyogenes* obtained from different sources, not from streptococci of known differences in reaction.

ment of ulcerative endocarditis. Wright's work gave renewed stimulus to those who were following up the efforts of Koch and others in treating certain tuberculous infections by the new tuberculin. It also suggested that a more general application of the principle of vaccine therapy might be made, and that trial of the principle might profitably be given in infections due to other pyogenic cocci than the staphylococcus. Good results were not slow to appear in regard both to the pneumococcus and to various streptococci, when occurring in connection with localised and chronic affections. Still later, trial of bacterial vaccines was made in certain generalised infections, both chronic and acute. Although at present the treatment of these conditions by specific inoculation is of too recent origin to admit of any definite conclusions, enough has been accomplished in particular instances to give promise of very important issues in the near future. In the treatment of malignant endocarditis by specific inoculation, a ray of hope has appeared where previously the outlook had been dark and despairing.

The only fully recorded case that has as yet appeared, in which a patient, said to be suffering from "infective endocarditis," seemed to be cured by vaccine-therapy, is that published conjointly by Sir James Barr, Dr. Blair Bell, and Captain Douglas. The patient was a young woman, æt. 25, who developed a sore throat, followed by a large swelling behind the angle of the jaw, and later by a condition of acute streptococcal pyæmia, with pleurisy, venous thrombosis, and an abscess "in the foot." The note concerning the state of the heart reads: "After the patient had been under observation for about a fortnight, symptoms of endocarditis of the right ventricle were detected; at first very slight, these gradually became more pronounced; there was dilation of the tricuspid orifice accompanied by a slight murmur and pulsation of the veins in the neck and in the liver, which became large and rather tender. The left ventricle was not enlarged and there was no enlargement of the spleen." No embolism occurred in any organ. No signs of any residual mischief in the heart were detected during or after convalescence. From the record of the case the evidence of an infective heart lesion does not seem very convincing: the signs described may well have been due

to a temporary dilatation of the right heart with associated tricuspid incompetence, a not uncommon condition in cases of septicæmia. If, as is probable, a severe grade of anæmia was present, although no reference is made to this, the condition mentioned would be contributed to by this factor. In referring to the case in a recent article, Sir A. E. Wright says, "A cardiac murmur now developed and the case assumed all the character of an infective endocarditis." But this epitome is certainly not justified by the clinical record. On the other hand, Sir James Barr is of opinion[1] that he and his collaborators were dealing with a genuine instance of infection of the right side of the heart, for in many respects the case resembled one previously under his care, in which an ulcerating lesion was discovered post-mortem on the wall of the right ventricle. In the treatment of this case, Captain Douglas used doses of streptococcus vaccine, ranging from six to twelve million cocci, making nine inoculations in all, over a period of one month, and controlling these inoculations by frequent observations of the patient's opsonic index. The streptococcus used for the preparation of the vaccine was, of course, isolated from the blood of the patient. It would be of much interest to know the characters of the streptococcus, for these would undoubtedly assist in settling the moot question of the existence of an endocardial lesion. The patient made a complete recovery, and remains in perfect health to-day.[2]

In the article referred to above, Sir A. E. Wright and others make reference to three cases of undoubted ulcerative endocarditis of streptococcal origin treated unsuccessfully by vaccines. The same authors also refer briefly to one case of mitral disease, complicated by cerebral embolism, in which a staphylococcus was cultivated from the blood, and in which an occasional pyrexia present before treatment disappeared after specific inoculations were made. It is to be hoped that a more detailed account of this case will shortly be forthcoming.

My own experience of vaccine-therapy in ulcerative endocarditis is concerned with four cases of infection of the heart valves by streptococci and two cases where the micro-organism was the "influenza" bacillus. In two of the streptococcal

[1] Private communication to the writer.
[2] *Ibid.*

cases, some amelioration of the pyrexia and of the general condition appeared to follow for a short time, but in none of them did recovery take place. In the course of the disease, quite apart from any sort of treatment, there not infrequently occur periods of relative quiescence, and this fact must be remembered in interpreting the results of treatment. But as it is extremely unlikely that natural recovery ever occurs in cases of chronic malignant endocarditis, this event, should the physician have the good fortune to witness it, may safely be attributed to his interference by way of treatment. The tests of recovery are (1) absence of pyrexia, (2) gain in weight and colour, and, best criterion of all, (3) sterility of the blood in repeated cultures undertaken so as to give the utmost chance of growth to any micro-organism present in the circulation.

These criteria of recovery have recently been observed by the writer in a patient who has been under treatment by him in conjunction with Dr. H. H. Rubra, with whom the case was first seen in consultation at Crouch End in November, 1907. A man, aged 37, was found to be suffering from (1) aortic regurgitation with secondary mitral regurgitation, (2) pyrexia, irregular in type, the temperature varying from 100°—102° each evening, (3) progressive loss of flesh and colour, (4) a crop of small hæmorrhages scattered over the chest and neck, (5) a palpable spleen, (6) albuminuria, (7) defective vision in the right eye due to retinal hæmorrhage, (8) "rheumatic" pains in the hands and feet, and (9) a large, painful swelling at the lower part of the left popliteal space, which had arisen suddenly after a shivering fit. The nature of the swelling soon became apparent as a dissecting aneurysm of the posterior tibial artery following embolism. A blood-culture, undertaken by removing 5 c.c. of blood from a vein at the bend of the elbow, gave a pure and copious growth of the "influenza" bacillus, in each of four broth tubes and on two agar slopes. Both the diagnosis and the nature of the infection were thus established. Subcultures of the bacillus were made on nutrose ascitic agar. After 48 hours' growth the colonies were scraped off the medium and a weighed amount of the bacilli transferred to a known quantity of sterile normal salt solution. This was heated to 60° C. for twenty minutes, and measured out into sterilised ampoules, which were then sealed. Each ampoule

was calculated to contain ± 0·1 mgr. of the killed bacilli in 0·5 c.c. of salt solution. Four of these doses were given at intervals of four days, close observations being made of the patient meantime. Improvement seemed to occur after the third and fourth doses, though it was very slow. No ill effects, local or general, were seen at any time. After these four doses had been given a period of a month elapsed without further inoculations. A second blood-culture was then undertaken, and again a pure growth of Pfeiffer's bacillus was obtained, but the colonies were rather fewer in number. A second vaccine was prepared from the newly-obtained bacillus, and a second series of four inoculations were made, the dose of each being now ± 0·2 mgr. of killed bacilli. The spacing of the doses was as before. The slow improvement continued, particularly a sense of increased vigour and comfort being apparent to the patient. But there was also distinct gain in flesh and colour, the pyrexia became less marked, and the swelling in the leg was much smaller and ceased to be painful. A third blood-culture, undertaken six weeks after the second series of inoculations was begun, has proved quite sterile. The patient is being wheeled out in a Bath chair, and the infective part of his disease appears to have been temporarily, if not permanently, arrested. There are still, of course, abundant cardiac and vascular signs of aortic regurgitation. The choice of dose and the times of administration of the doses in this case were not influenced by estimations of the patient's opsonic index to Pfeiffer's bacillus, but were determined by experience gained in the treatment of other cases, and by close observation of the patient during the treatment. Apart from the fact that employment of "opsonic controls" in the streptococcal cases had not convinced the writer that they were of any service, there was here the inherent difficulty of dealing with a micro-organism which would only grow on a medium containing fresh blood. An emulsion of the micro-organism prepared for opsonic determinations would therefore contain bacilli already "opsonised" in some measure,—a fallacy great enough to vitiate results.

THE TUBERCULIN (T.R.) TREATMENT OF TUBERCULOSIS OF THE GENITO-URINARY ORGANS.

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TUBERCULOSIS of the genito-urinary organs occurs in two anatomical forms, (1) tuberculous ulceration of a mucous surface, and (2) a tuberculous process embedded in an organ, and leading to the formation of caseous masses. Vesical tuberculosis is the most frequent example of the former variety, while the caseous nodules are to be found in the kidney, prostate, and in other parts of the genital system.

The effect of tuberculin must vary in these two forms. Further, some distinction must be made between genital and urinary tuberculosis, for the former usually pursues a slow course extending over many years, sometimes healing up in one part of the genital system and breaking out in another after a period of quiescence, or, again, planting its colonies in one genital organ after another until the whole genital system is tuberculous.

In the bladder, on the other hand, the disease is usually rapidly progressive. It is singularly liable to the addition of septic infection, and, moreover, vesical tuberculosis is peculiarly sensitive to climatic and dietetic influences. A cold damp day, or the ingestion of some unsuitable food or drink may aggravate the symptoms, and dissipate the improvement of many weeks, whereas warm, genial weather may give the impression of rapid progress. Observations made upon such cases over a period of a few weeks or even months are therefore likely to be misleading, and longer periods of time must elapse before permanent results can be recorded.

The following varieties of genito-urinary tuberculosis will be considered.

(1) Genital tuberculosis.

(2) Urinary tuberculosis.

(3) Genito-urinary tuberculosis.
(4) Tuberculosis of the genital or urinary systems complicated by tuberculous disease elsewhere.

(1) GENITAL TUBERCULOSIS.

I shall refer in the first place to tuberculosis of the epididymes, seminal vesicles, and prostate. The following notes illustrate the progress of such a case (see page 726).

W. F., a pianoforte maker, aged 48, noticed a swelling of his right epididymis 19 years ago. This was followed in a few months by swelling of the left epididymis. When I examined him, in 1900, there was a firm rounded swelling of the right globus minor and a hard irregular enlargement of the lower half of the left epididymis. There was tuberculous deposit in the left seminal vesicle and left lobe of the prostate.

In 1903, the lesion of the right epididymis had increased to a cyst-like mass the size of a marble, while the left epididymis was hard and craggy. The right vesicle now contained tubercle, and there was a small nodule in the right lobe of the prostate. Injections of tuberculin were commenced in November 1903, and have been continued at intervals of a fortnight to a month until the present time (August 1907) —nearly four years. The lesions continued to increase in size during the early part of the treatment. In July 1904, the masses in the epididymis were softer, and, during this year, the lesion of the left epididymis broke on the surface and healed again several times. At this time the swelling of the left lobe of the prostate collapsed, the tuberculous abscess having ruptured into the urethra.

In May 1905, 18 months after the commencement of the treatment, distinct improvement was observed in the lesions. The cyst-like mass in the right globus minor rapidly softened and diminished in size, and the craggy lesion of the left epididymis became softer and smaller. The prostate and vesicles remained unchanged. In 1906, there was continued improvement in the condition of the epididymis, and the vesicles and right side of the prostate were appreciably smaller. Recently (August 1907), the right epididymis was soft and

the remains of the large cyst hardly distinguishable, while the left epididymis showed two small tough nodules in place of the hard craggy mass. The prostate and vesicles were represented by a Y-shaped track, hard, well defined, and somewhat irregular on the surface, but apparently quiescent. The opsonic index was 0·9. The progress of this case is graphically shown in the accompanying figure.

It is a difficult question to decide whether the improvement is to be ascribed entirely to the administration of tuberculin. No other drugs have been given during this period, and no change in the food, habits, or surroundings of the patient has been made. At the same time it must be remembered that genital tuberculosis shows a tendency to heal spontaneously, and may leave but little trace of its previous existence.

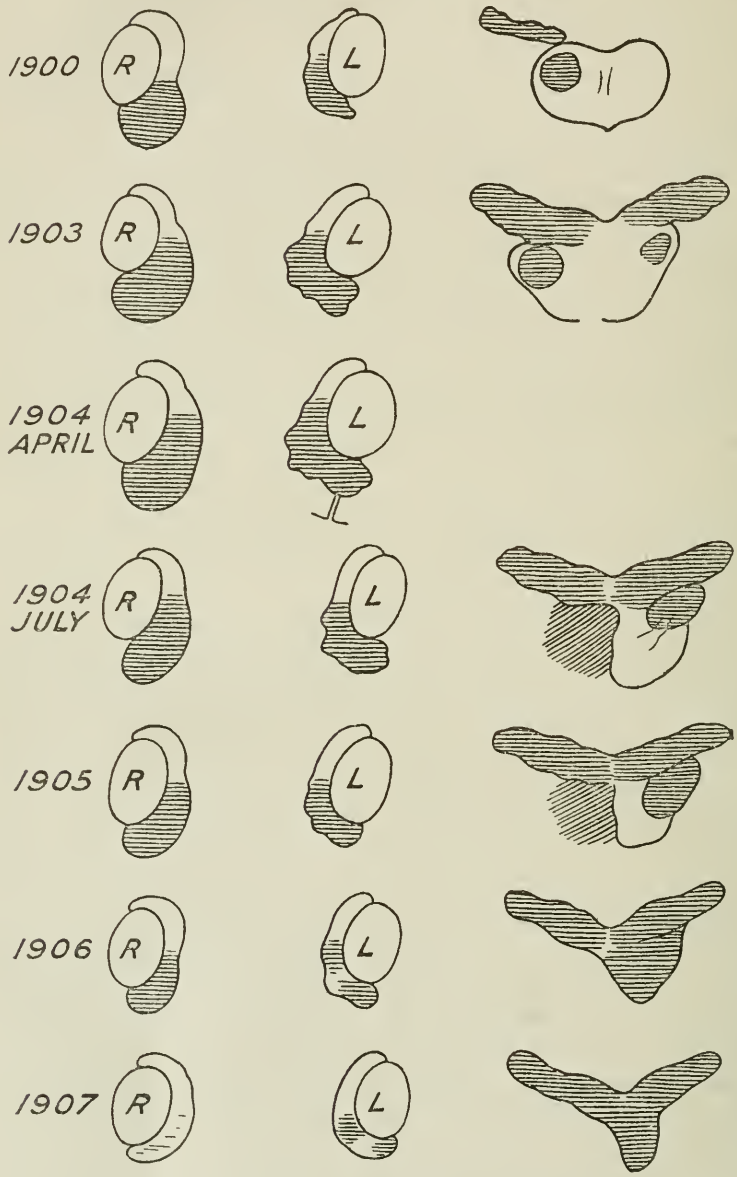
No change was observed for 18 months after the commencement of the treatment. It was hardly conceivable, however, that large caseous masses of tuberculous material could be removed in a shorter time by this means. There was, therefore, nothing incompatible with the belief that the tuberculin had brought about the change.

If we accept this as an illustration of the change, which may be expected to follow the administration of tuberculin in genital tuberculosis, it is important to compare it with operative treatment. The tuberculous epididymis and the testicle may be removed, and the prostate and seminal vesicles dissected away.

When a single epididymis is involved there can be no doubt that its removal may terminate the tuberculous disease. And the removal of the epididymis alone will always be preferable to castration when this is possible. Where both epididymes are affected, without palpable deposit in the prostate and seminal vesicles, bilateral epididymectomy may be carried out, although, in these cases, it must be doubtful whether there is not already an unfeelable deposit in the prostate or vesicles. But when there is advanced disease of the prostate and vesicles, the removal of the tuberculous disease involves a very extensive operation, the results of which are by no means uniformly good.

The chief danger of genital tuberculosis is that it may break into the urinary system, and the onset of symptoms of cystitis in such a case should, I believe, be the signal for operative

interference in the genital tubercle. Short of this, however, I am not in favour of heroic operations for tuberculous disease



Graphic record of progress of Tuberculosis of the Epididymes, Seminal Vesicles, and Prostate. Tuberculin treatment commenced in November 1903. *Shaded areas represent tuberculous deposit.*

of the genital system, and am inclined, from the tendency of these lesions to contract and obsolesce, and from the benefit obtained from tuberculin, to trust rather to the latter and to general treatment in the conduct of these cases.

(2) URINARY TUBERCULOSIS.

Primary Tuberculous Disease of the Kidney.—In the earlier stages of renal tuberculosis, when tuberculin might be expected to act with greatest advantage, the symptoms may be so slight and indefinite that a diagnosis of their cause is not made. Not infrequently, the first indication of the presence of urinary disease is the onset of symptoms of cystitis produced by the spread of the tuberculous disease along the ureter to the bladder.

In the earlier stages of primary renal tuberculosis, a dull aching pain in one kidney may be the subject of complaint. Occasionally there may be a burst of hæmorrhage, and this may be repeated. The urine is hazy with suspended pus cells, and contains fine flakes when the lesion is in the renal pelvis or communicates with it. It is faintly acid and is usually deficient in urinary pigment. Tubercle bacilli may be found. The kidney is not enlarged or tender.

In such cases, it is difficult to estimate the extent of the disease and therefore to follow its progress. The opsonic index of Wright is an invaluable guide to treatment here.

I have treated several cases of primary renal tuberculosis at this stage, but found it difficult to appreciate any improvement, and the patients, wearied of a treatment which gave so little apparent relief, either clamoured for operation or went elsewhere.

The following case of early tuberculosis of the kidney derived benefit from the treatment.

J. W. (I 421), a printer, aged 32, came under my care at St. Peter's Hospital in July 1904. Two years before, he had a sudden attack of pain in the right kidney shooting into the groin and testicle, followed by a dull renal ache. At that time he passed dark blood in his urine, and he had another attack of hæmaturia lasting five days a fortnight before I saw him. There were no symptoms of disease of the bladder.

He had a Pott's curvature dating from 12 years before, and a "cold abscess" had opened on the loin two years later. Twelve years ago, a Pirigoff amputation had been performed for tuberculous disease of the left foot. The kidneys were not tender, but the right was slightly enlarged. He was put on tuberculin injections commencing with $\frac{1}{2\,5\,0}$ mgr., and repeating the dose once a month, and gradually raising it, until $\frac{1}{2}$ mgr. was reached, and this has been continued, with sometimes slightly longer intervals, till the present time (three years). Almost from the first his weight increased, and he is now heavier by about a stone. Blood has not appeared in the urine since the treatment commenced. For eight months the pain in the kidney continued to be troublesome. After that it steadily diminished, until January 1906 (17 months' treatment), when it had disappeared. At this time the injection was reduced to $\frac{1}{1\,0\,0\,0}$ mgr., and the pain almost immediately became noticeable and steadily increased until July 1906. The dose was then raised. In February 1907, I noted "no pain since increased dose and can get through his work better," and, in July 1907, "with larger doses less pain."

The patient remains under treatment.

There are many cases of primary renal tuberculosis which do not present any symptoms until the bladder becomes involved by spreading down the ureter and a persistent subacute cystitis calls for investigation. These cases will be considered under the category of reno-vesical tuberculosis.

Reno-vesical and Vesico-renal Tuberculosis. — In many cases, where the bladder and kidneys are tuberculous, it is impossible to say clinically, and difficult to judge post-mortem, whether the disease was primarily renal or commenced in the bladder and spread upwards. Clinically we have to deal with tuberculous cystitis of some duration. The detection of renal disease in such a case is often difficult, for no signs or symptoms of disease of the kidney may be present. But there may be dull aching pain in one kidney not greatly affected by movement, and in some cases there are attacks of ureteral colic. The kidney is seldom enlarged on palpation of the abdomen. It may, however, be slightly enlarged, hard and tender. Cystoscopy will show that the opening of the ureter is large and the edges reddened, infiltrated and rigid.

Later, the orifice may be displaced outwards and lie in the depth of a tunnel "dragged out ureter" (Fenwick). Catheterization of the ureters will demonstrate changes in the urine of the affected side, and the use of the methylene blue or phloridzin tests will show a diminished renal function on this side.

Tuberculin may be used in two ways in these cases—in combination with operative treatment, or to replace it.

There are certain of these cases that are beyond the hope of cure by operation when the diagnosis is made. There is advanced disease of one kidney and the second kidney is destroyed by the same disease.

In such a case, death would take place from anuria in a few days after nephrectomy. These inoperable cases of renal tuberculosis would appear to be suitable for the administration of tuberculin. It has been shown, however, that actual harm may result from the administration of tuberculin when the ureter is seriously involved (Fenwick). Swelling of the mucous membrane is said to occur, and the already narrowed duct becomes occluded. This is followed by septic infection of the retained urinary and tuberculous products.

But these results were obtained after large doses of tuberculin had been injected, and it is possible to give small doses so that this swelling of the tuberculous ureter does not take place, or at least the renal pain and tenderness, which indicate the blocking of the lumen, do not appear.

I have not met with a cure, or any case approaching a cure, in this class of tuberculous disease. But there has been undoubted improvement after the institution of the tuberculin treatment. It seems almost too much to expect that large masses of caseous material will undergo absorption with this treatment. If, however, we may take a hint from the case of genital tuberculosis already described, a considerable period of time might be expected to elapse before the full effect of the tuberculin was obtained. Such a period, unfortunately, is seldom afforded in these cases.

The following case may be quoted in illustration. I was asked to examine Mrs. W., aged 30, on account of symptoms of cystitis, which had persisted for 18 months, and were gradually becoming more severe. On cystoscopy, there was

tuberculous disease of the mucous membrane irregularly disposed over the whole surface. The right ureter was displaced upwards and outwards and was surrounded by yellow granular tissue. The left ureter was normally placed and was long and slit-like, with an infiltrated area around it. The right ureter could be felt from the vagina thick and cordlike. The right kidney was palpable, hard, and somewhat irregular, but not enlarged. Operation upon the right kidney was not considered advisable, and tuberculin injections were commenced. Three weeks later, the vesical pain had disappeared, and the terminal hæmaturia had not recurred. The frequency of micturition had diminished to two hours during the day and three hours at night. The temperature had fallen to 99. She put on flesh and improved in appearance. The opsonic index was 1·6. In six weeks, the symptoms had still further improved, the tubercle bacilli had disappeared from the urine, but streptococci were present. Symptoms of renal failure set in a little over three months after the commencement of the treatment, and death followed in three days.

Tuberculin treatment may be used as an adjunct to operation in cases of reno-vesical tuberculosis.

The cystitis, complicating renal tuberculosis, may disappear on removal of the kidney. In such case, it is open to doubt, if characteristic tuberculous lesions have not been observed with the cystoscope, whether the cystitis was actually tuberculous or merely due to the irritation of the discharge from the diseased kidney. On the other hand, the cystitis may, and usually does, persist, and with it the symptoms which cause the patient most distress. In such a case, tuberculin is a valuable adjunct to operation.

In the following case, improvement followed the use of tuberculin.

N. F. came under my observation at St. Peter's Hospital in August 1906. There had been constant aching in the left kidney for eight months. This was worse in the morning and aggravated by violent exercise. Nocturnal calls to micturition had been present for six months, and there had been blood in the urine for a few days. The frequency of micturition was half-hourly during the day and two-hourly at night. The left kidney was large and tender. On cysto-

scopy, there was general tuberculous cystitis, and the left ureter was retracted. On September 5th, a large tuberculous left kidney was removed, and a month later tuberculin treatment was commenced. During the 12 months' treatment, she has steadily increased in weight, and the frequency of micturition is now hourly instead of half-hourly and the pain much less. The improvement has been slow but is undoubted.

Primary Vesical Tuberculosis.—In not a few cases (10 in 42 cases of genito-urinary tuberculosis) of tuberculosis of the bladder, no disease of the kidneys is present in the genital system. The diagnosis from other forms of subacute cystitis rests upon cystoscopy, and the discovery of the tubercle bacillus in the urine.

In such cases, the best results may be obtained from the tuberculin treatment. Sometimes, after two or three injections, the patient will report improvement, less often the symptoms persist in equal or increased severity, and an improvement is only obtained after many months of treatment.

The patient first experiences an increased vigour, then the pain diminishes and disappears, and the calls to micturate become less troublesome. From a frequency of 15 minutes during the day and incontinence at night, improvement to two-hourly micturition during the day and once or twice at night may be attained in the compass of several months. Terminal hæmaturia gradually ceases, and the occasional burst of hæmorrhage, which complicates some of these cases, occurs at long intervals or ceases. The urine remains for long without change, but may eventually become clear, and the urinary pigment which was deficient increases. The tubercle bacilli disappear from the urine, and the patient puts on weight.

I have selected the following case from a few in which the tuberculous process has apparently been arrested.

G. C., a signalman, aged 31 years, was sent to me by Dr. Strickland Goodall, in July 1903, on account of hæmaturia and hæmoptysis. Symptoms of cystitis had set in four years before, and had gradually increased in severity. On cystoscopy, there was ulceration on the left side of the bladder, and in the neighbourhood there were groups of fine tubercles.

For four months, he was treated with various drugs, but the symptoms remained unchanged and he steadily lost weight. Tuberculin injections were commenced, in November 1903, with $\frac{1}{250}$ mgr., and were repeated every fortnight. In January 1904, the urine was unchanged. He had ceased to lose flesh and his weight remained stationary. He held his urine for four hours during the day, and rose once at night. He felt much stronger and had regained his former vigour. With the cystoscope, groups of tubercles were still to be seen, but the ulceration was much less extensive. In March 1904, there was some expectoration containing blood, but Dr. Goodall could detect no physical signs of lung trouble. He continued to pass blood at intervals of about a week during the early part of 1904, but he had begun to gain flesh and his appearance improved.

In August 1904, there was a burst of hæmoptysis and hæmaturia. From September 1904 to January 1905, he gained a stone and a half in weight. Cystoscopy, in June 1905, showed a few fine tubercles on the left lateral wall far back. The ulceration had healed. In September 1905, there was no pain or hæmaturia. He passed urine three or four times a day and not at all at night. The urine was still hazy and contained a trace of pus. In January 1906, the injections were reduced to $\frac{1}{1000}$ mgr., and given every three weeks. Blood appeared in the urine, and was present for some weeks. It disappeared, and the urine gradually cleared under increased doses. The urine remained absolutely clear, and there were no symptoms for several months. In July 1907, he had an attack of cystitis. The urine had the appearance of bacteriuria. No tubercle bacilli were found but numerous staphylococci were present. He is now recovering from this attack of staphylococcal cystitis, and feels well and vigorous.

(3) GENITO-URINARY TUBERCULOSIS.

In the greater number of cases of vesical tuberculosis in the male, the bladder is affected by the spread of the disease from the genital system. In 42 cases of tuberculosis of the bladder in male subjects under my care, the disease was confined to the bladder in 10, and in 32, tuberculous foci were found in other parts of the urinary, or in the genital system.

The genital organs were affected with the bladder in 23 cases. The problem that most frequently arises, therefore, is the treatment of this combination. It cannot be said that the usual methods of treatment have proved successful in dealing with this class of case. These patients steadily lose ground under the various methods of local and general treatment, and they are eminently suited for a trial with the tuberculin treatment. In none of my cases have I been able to bring about a cure by this means, although the injections have been given over long periods, but, in most cases, a considerable amelioration of the symptoms was obtained. The distressing frequent and urgent micturition which prevents the patient from following his employment, and disturbs his rest at night, is diminished, sometimes to a remarkable degree. The improvement in the different symptoms proceeds along the lines I have indicated in primary tuberculosis of the bladder.

I shall very briefly refer to two cases in illustration of this class.

W. H. S. (IV. 398), a compositor, aged 38, came under my observation, in January 1907, with symptoms of cystitis of 18 months' duration. *Per rectum* a large hard left seminal vesicle was felt, and the left lobe of the prostate contained a hard nodule. Tubercle bacilli were found in the urine. The cystoscope showed a patchy cystitis without definite tubercles. Injections of $\frac{1}{2000}$ mgr. tuberculin were commenced and gradually increased to $\frac{1}{800}$ mgr. In July 1907, I noted much better, gaining flesh, pain slight, no blood since 14 days after commencing the tuberculin, passes urine every two hours, or less frequently during the day."

The following case showed even more striking improvement.

E. W. (I. 335), a clerk, aged 18 years, had for four months a daily frequency of micturition of 10 minutes, and incontinence at night. There was penile pain, and the urine was thick and milky. There was a hard irregular nodule in each globus minor, the left lobe of the prostate was replaced by a deep depression, and above this a hard craggy seminal vesicle could be felt. The urine was pale, hazy, and contained many fine shreds, and a few tubercle bacilli.

Injections of tuberculin were commenced in January 1904. Four months latter he was gaining weight, the pain was

less and the frequency of micturition 1½ hours during the day and two hours at night. In November 1905, he had gained half a stone in four months. He passed slightly murky urine every three hours during the day and twice at night. In March 1906, the urine was clear, and the frequency of micturition was every three hours during the day and once at night. In May 1906, he was still gaining weight and the urine was clear.

(4) TUBERCULOSIS OF THE GENITAL OR URINARY SYSTEMS, COMPLICATED BY TUBERCULOUS DISEASE ELSEWHERE.

The cases which showed themselves least amenable to the tuberculin treatment, were those in which a tuberculous process was active in some other part of the body. Cases of obsolete tubercle were not uncommon, the disease having usually affected bones or joints. The progress under treatment was apparently uninfluenced by the old trouble. But in cases, in which the tuberculous process in other parts of the body was still active, the results were almost uniformly bad.

In only three cases have I seen active pulmonary tuberculosis complicating urinary tubercle, and in two of these the physical signs in the chest were insignificant. One case did well with tuberculin ; the other two died.

One patient came to me from a chest hospital with advanced phthisis and epididymal and vesical tuberculosis. His vesical tuberculosis appeared to improve under tuberculin, but while he was under my observation his pulmonary condition got worse. He left me to return to the chest hospital and returned after several months improved in general health, and with less pulmonary distress, but his genito-urinary tuberculosis had gained ground. He again improved under tuberculin, and his pulmonary condition became worse, and I urged his return to the chest hospital. I afterwards heard that he had died.

Another patient had tuberculous teno-synovitis of the left peronei sheaths, which I dissected away. I could make no impression upon his vesical tuberculosis with tuberculin.

In another man, there was, in addition to tuberculosis of the seminal vesicles, epididymis, and bladder, an active spinal caries, with bilateral psoas abscess, one of which had opened

into the rectum. He attended irregularly, and the tuberculin appeared to do him no good.

Remarks.—The foregoing cases show that the tuberculin treatment finds its most promising application in primary and secondary vesical tuberculosis, and that it is of value as an adjunct to operative treatment in reno-vesical and genito-urinary tuberculosis. The tuberculin used in all those cases was Koch's T.R., supplied by Messrs. Allen and Hanburys. In my earlier cases, I used doses varying from $\frac{1}{250}$ mgr., up to $\frac{1}{4}$ or even $\frac{1}{2}$ mgr., at varying intervals of a week, a fortnight, or a month. A reaction, shown by a rise of temperature, general aching and malaise, was the signal for a smaller dose given at a longer interval. Later, I used doses of $\frac{1}{2000}$ up to $\frac{1}{500}$, and was guided by the opsonic index as regards dosage and interval of administration. In most cases, injections of $\frac{1}{2000}$ could be administered weekly or fortnightly, and gradually increased to $\frac{1}{500}$, or even higher.

The opsonic index is an invaluable guide to the dosage and frequency of administration of tuberculin in genito-urinary tuberculosis. In renal tuberculosis, there is no other means of measuring progress, for the symptoms are slight or intermittent, or sometimes entirely absent, and tenderness and enlargement of the kidney are not often present.

In genital tuberculosis, the foci can be examined with the finger, and any change noted, but, as I have already observed, progress in these cases is extremely slow, and can only be appreciated over a period of months. The opsonic index provides a means of checking the administration of tuberculin in these cases. In vesical tuberculosis, the symptoms afford considerable assistance in following the effects of the treatment. The frequency of micturition, terminal hæmaturia, pain, and general feeling of well-being of the patient are rapidly influenced by any improvement that takes place in the cystitis, and form an important guide to dosage.

Among my patients there were some who complained, when the strength of the injection was reduced, that the pain increased, the frequency of micturition became more pressing, and they felt weak and lethargic, and these patients improved when the doses of tuberculin were again raised. There were other cases in which no improvement was obtained, and when

the opsonic index was estimated, it was found to be low (0·6 — 0·7), and these patients were improved by an increase in the dose of tuberculin. Again it was found, in some cases, in which the condition was stationary, that the opsonic index was high (1·1), and the injections were reduced without any increase in the severity of the symptoms.

After injections of tuberculin a rise in the index followed a short negative phase. Thus, in a case of tuberculous disease of the bladder (W.T.L.), the index, 9 days after the last injection of tuberculin, was 0·8, the day following the next injection, it was 0·6, and two days later it had risen to 0·9. This patient felt stronger and had less pain after an injection, but towards the end of a week the improvement gradually failed until the next dose was given. Small doses of $\frac{1}{2000}$ and $\frac{1}{1000}$ were without effect in relieving his symptoms.

In another case of tuberculous disease of the prostate, bladder, and left kidney, the opsonic index was 0·8 four weeks after an injection of $\frac{1}{1000}$. It had risen to 1·2 two days after the next injection of $\frac{1}{1000}$, and ten days later it had fallen to 0·8.

A marked negative phase, lasting for three days, and giving an index of 0·5, was produced by an injection of $\frac{1}{200}$ mgr. in a patient suffering from vesical tuberculosis in a case of reno-vesical tuberculosis, after nephrectomy had been performed. The index rose to 0·9 fourteen days after the injection.

Some of these patients have been under the influence of tuberculin for four years, or even longer, with varying periods of rest from time to time.

In vesical tuberculosis, climatic and dietetic influences are apt to mislead the judgment, if observations are not made over a sufficiently long period of time.

These patients appear to be specially disposed to the invasion of other forms of infection. Two patients suffered from sudden attacks of staphylococcal and streptococcal cystitis, when apparently well or improving from tuberculous cystitis. Another had an acute attack of epididymitis, which was apparently of a similar nature.

THE OPSONIC METHOD AND VACCINE-THERAPY IN RELATION TO DISEASES OF THE EYE.

By R. W. ALLEN, M.B., B.S.,
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OPHTHALMIC surgeons would probably be the first to admit that little further progress in ophthalmology is to be expected from surgery pure and simple: the establishment, on the other hand, of a bacterial origin for such intractable conditions as trachoma, Mooren's ulcer, spring catarrh, and sympathetic ophthalmia, would at once bring them within the zone of the opsonic method of treatment, and hold out considerable promise of success. The scope for vaccine-therapy in diseases of the eye is already great and is steadily increasing. The first essential for its success is accuracy in the determination of the infecting organism or organisms. The discovery of Calmette's ophthalmo-reaction has added considerably to the ease with which the diagnosis of a tubercular infection may be made: as I have shown,[1] the tuberculo-opsonic index in tuberculosis of the eye is extremely variable; it may be as low as 0·4 or 0·5, or as high as 2·2, In all eye infections the index is usually well above the normal limits, but inasmuch as tubercular disease of the eye is frequently secondary to, or associated with, tuberculosis elsewhere, either of the glands, joints, or lungs, this latter tending to the production of a lowered index, the two factors working in opposite directions often result in the maintenance of a normal index. This adds considerably to the difficulty in deciding, from estimations of the tuberculo-opsonic index, whether a suspicious eye lesion is tubercular or not. Were it not for the fact that Calmette's reaction is a test for tuberculosis wherever situated, the difficulty in diagnosis would be almost entirely obviated by its use. As it is, great care is necessary in excluding tuberculosis elsewhere, especially in children, whose mesenteric and bronchial glands are so often infected by the tubercle bacillus, before accepting a positive reaction as conclusive evidence of ocular tuberculosis.

[1] *The Opsonic Method of Treatment*, p. 135.

A few words of warning with regard to this reaction may not be misplaced. In the first instance, the general effect is precisely that of a subcutaneous injection of tuberculin, and a "negative phase," often considerable alike in duration and amplitude, is succeeded by the customary "positive phase." Observations of the resultant "negative phase" tend to indicate that the amount of tuberculin administered is unnecessarily large. Clinical observations of the local effects confirm this view. Although the reaction, as a rule, subsides within three or four days, it is occasionally very severe, and lasts for even two or three weeks, and may be accompanied by aggravation of the keratitis or irido-cyclitis, from the prolonged and excessive resultant "negative phase," or even by corneal ulceration or the production of a phlyctenule. These undesirable results may be obviated by the employment of a tuberculin solution of 0·5 per cent. strength instead of a 1 per cent. solution, and by the instillation of not more than a single drop into the conjunctival sac.

In a few cases of unquestionable tuberculosis, a positive result is not obtained, at all events, at the first attempt—a second administration must therefore be given in suspicious cases if the first fails, and help must be sought from determinations of the opsonic index before and after the instillation of the tuberculin, precisely as is done after its subcutaneous injection.

Assuming that a diagnosis of tuberculosis has been satisfactorily established, consideration must still be paid to the question as to whether the human or bovine type of the bacillus is at work. That man is susceptible to both varieties of the tubercle bacillus is now admitted, and Raw has endeavoured to establish means of differential diagnosis between them. So far as I am aware no effort has been made to determine which variety is responsible for ocular tuberculosis. It would, however, appear, as tuberculosis of the eye is sometimes secondary to tuberculous glands, especially in children, which are probably bovine in type, and, as it is again sometimes secondary to pulmonary phthisis, which is usually due to the human type, that therefore ocular tuberculosis may be due to either type of the tubercle bacillus. Till recently, T.R., prepared from the human type, has been

exclusively employed in treatment; this obviously cannot be appropriate to a certain percentage of cases, and the author is engaged upon a series of experiments upon this question. A certain number of cases, which showed but slight improvement under human T.R., have done much better with bovine T.R., but no definite statement can at present be made. Meanwhile the tuberculin may be selected according to one or other of the following considerations:—

(*a*) If the ocular tuberculosis appears primary, begin with human T.R.; if no definite improvement appears in between two and three months, substitute T.R. of bovine origin; or, as an alternative, commence with tuberculin of both strains mixed in equal proportions.

(*b*) If the ocular tuberculosis is secondary to, or associated with, tuberculosis elsewhere, employ the tuberculin appropriate to the primary infection. Thus, if secondary to apical pulmonary phthisis, use T.R. of human origin, while ir secondary to cervical or mesenteric glands, use T.R. of bovine origin.

Professor von Hippel holds that T.R. rightly used will cure the severest tuberculosis of the eye. The experience of other observers is also very favourable, but the question also arises as to what is the right use. According to the author's experience very small initial doses should be employed, 0·00001 cc. of either tuberculin being ample to begin with. The negative phase is often very prolonged in eye cases, but the subsequent rise an ample one; it therefore follows that in order to ensure the best results, no injection should be repeated without prior determination of the index. If this cannot be done, it is much better to wait overlong than to inject prematurely. Three-weekly intervals are often too short, and clinical appearances are not a very trustworthy guide. Should determination of the index not be possible, it is therefore advisable to inject at intervals of a month, beginning with ·00001 cc., and but slowly increasing the dose till a maximum of about ·00006 cc. is ultimately attained.

Failure to improve under this treatment is an indication to change the variety of the tuberculin. Under this procedure choroidal nodules may be watched disappearing by means of the ophthalmoscope, gradual shrinkage occurring till nothing

is seen but a white scar, or total absorption occurs: keratitis and iritis are markedly benefited, but the local condition may be slow to improve and persistent treatment may be necessary.

The general improvement in the patient's condition and the increase in weight are often rapid and very marked. None the less every possible help must be sought from other therapeutic and hygienic measures; the patient should be placed under the best conditions, and, in iritic cases, the congestion must be relieved by the usual methods.

My experience with phlyctenules and episcleritis has not been very favourable to tuberculin treatment, a result which has been borne out by the frequency with which such cases fail to respond to Calmette's reaction, and it would appear that only a comparatively small proportion of such cases are of tubercular origin. Such as do respond would probably do well with one or other of the varieties of tuberculin.

Tuberculosis of the bony orbit does extremely well under this treatment, but should staphylococci or streptococci complicate the infection, then a vaccine, prepared from these organisms, must be simultaneously employed. The initial dosage of the former is 250,000,000, of the latter 75,000,000, whilst intervals of 17 to 21 days will probably be found suitable for the gradually increasing doses.

Other conditions there are in which opsonic treatment may be employed with marked advantage, as, for instance, in conjunctivitis, both acute and chronic. In the former of these, the processes are so active that serious damage may accrue to the eye unless prompt remedial measures are taken. Gonorrhœal conjunctivitis, especially in the adult, is an excellent example of this. The diagnosis having been established by means of smears, immediate injection with a dose of 125,000,000 of a stock vaccine should be adopted; by this means the active processes may be checked within 24 hours. Acute conjunctivitis, due to the pneumococcus, streptococcus, bacillus coli communis, or bacillus pyocyaneus, may be similarly treated, combined of course with such other therapeutic measures as the surgeon may deem advisable.

There are three forms of chronic conjunctivitis where considerable help may be afforded by injection of the corre-

sponding bacterial vaccines. Two of these are, it is true, uncommon, but are singularly intractable to ordinary treatment; I refer to the forms due to the tubercle bacillus and the bacillus of Friedlander. The latter of these is especially intractable, and may persist for years, whereas improvement may be anticipated from the administration of a single dose of 250 million organisms, and cure from three or four doses. The third form, by far the commonest variety of chronic conjunctivitis, is that due to the bacillus Lacunatus of Morax-Axenfeld, and occasionally proves very resistant to treatment, especially in old people. Such cases should receive two or three injections of 100 million organisms at intervals of two or three weeks, clinical appearances being sufficient guide as to the appropriate time for repeating the injection. Should cure not result, one or two doses of 250 million organisms will almost certainly achieve this end. This organism, though easy to isolate, yields but feeble growth, and the preparation of the vaccine is no easy matter; the results are, however, so satisfactory as to afford sufficient compensation for the trouble and expense incurred.

Corneal Ulceration.—The bacteriology of this condition requires further elucidation, but numerous organisms are certainly capable of its production. One of the most interesting of its chronic forms is the ulcus serpens corneæ, for which the pneumococcus is certainly responsible. Good results have been claimed in Germany by the use of anti-pneumococcal serum. The author has treated two such cases by injections of vaccines prepared from the patient's own organisms with gratifying results. One of these was in an old man of 80, under the care of Mr. Brookbanks James. The ulce was a severe one, with a large hypopyon, opaque cornea, and adherent iris. When excision seemed the only remedy, the pneumococcus was isolated and a vaccine prepared.

Despite the fact that the index was already 2·5, an injection of 250 million organisms was given. Within three days improvement began, and 15 days later a second similar dose was administered. Eighteen days after the second injection, the index was 6·3, and the inflammatory process had quite subsided. An operation was then performed upon

the large kerectasia present. Several months later the eye was quite quiet and free from irritability, and some slight vision was retained.

In another case of chronic corneal ulceration under Professor McHardy, one eye had already been removed for chronic ulcerative keratitis going on to perforation and shrinkage of the globe. Eighteen months subsequently the second eye was attacked, and became steadily worse, until vision was confined solely to the perception of a bright light. An iridectomy was performed, and cultures made from the iris, margin of the corneal incision, and scrapings of the edge of the ulcer. The same organism was isolated from each specimen in pure culture, a coccus, varying somewhat in size, which failed to retain the stain by Gram's method, grew well on blood agar and blood serum, but not so well on agar, and hardly at all on gelatine, while in broth it yielded a slight granular deposit upon the sides and bottom of the tube, the broth remaining clear. This organism has not been identified, but is probably a micrococcus pseudo-catarrhalis. A vaccine was prepared and four several injections given, two of 250 millions and two of 500 millions. Within three months of the first injection the patient was discharged, and when seen two months later the eye was quite quiet, the cornea diffusely nebulous, the vision, both near and for distance, $= \frac{1}{60}$th, and is still improving.

Of the acute forms of hypopyon ulcer, that due to the pneumococcus is especially benefited by vaccine therapy. Three such cases have been so treated by the author within the last month at the Royal Eye Hospital, two of these being under the care of Dr. H. Willoughby Lyle, who has very kindly furnished the following notes upon them. "A male, aged 49, was suffering from a rapidly infiltrating corneal ulcer, with hypopyon two-thirds up the aqueous chamber; local treatment was persevered with for 12 days without any improvement whatever taking place, in fact, the intraocular tension was raised, and the local pain so great (and as there was no perception of light) that it was almost decided to excise the eyeball. Vaccine-therapy, however, was commenced, and local treatment persevered with. In four days the hypopyon began to disappear, and the cornea to clear at the margins.

From that time until the patient left the hospital, four weeks later, the eye gradually improved. Altogether two injections of 250 millions and one of 500 millions pneumococci were given. On examination, two days after leaving hospital, the local condition was as follows:—There was a large irregular leukomatous patch somewhat vascular over the lower two-thirds of the cornea, a narrow ring of clearer cornea below the leukoma; the margin of the pupil could just be seen over the nebulous cornea above: the intraocular tension was normal, and the patient could distinguish between light and darkness.

The second case was in a child, aged 3 years 7 months, who was admitted to the hospital with a central corneal ulcer with infiltrating margins and a small hypopyon. In spite of local treatment the hypopyon increased, the ulcer spread, and the cornea ruptured. Vaccine treatment was commenced with a dose of 175 million pneumococci, and from that time the eye began to clear. When the child left the hospital there was a large 'leukoma adherens,' the cornea was somewhat vascular, there was a well-formed aqueous chamber, the iris was a good colour and reacted readily to light.

The favourable result obtained in these cases was very largely due to the vaccine treatment, and but for it the first-mentioned patient would undoubtedly have lost his eye."

The third case was under the care of Mr. L. V. Cargill, and was a very severe one. As soon as the pneumococcus was isolated, the house surgeon, Mr. Bell, gave a dose of 250 millions of the pneumococcal vaccine which had been prepared for case (1) of Dr. Lyle's. Improvement began within 24 hours and progressed with extreme rapidity, the hypopyon was rapidly absorbed, and the patient discharged within a week.

During the last fortnight, there have been in the hospital two cases of acute panophthalmitis. In both of these a coccus, which failed to retain the stain by Gram's method, was isolated in pure culture; in morphology and cultural reactions this organism appeared to be identical with the coccus isolated from the case of chronic ulcerative keratitis under Professor McHardy mentioned above. Unfortunately the progress of destruction was so rapid that vaccine therapy could not be utilised, but had the cases been seen earlier, and a stock vaccine

been at hand, I have little doubt that both eyes might have been saved and some amount of useful vision preserved.

As the bacteriology of corneal ulceration becomes better known, increased help may be confidently expected from treatment by bacterial vaccines.

Brief reference may finally be made to the assistance afforded the surgeon in such conditions as recurrent "hordeolum" and Meibomians, for which staphylococci are responsible, and in chronic dacryocystitis, which, as Eyre has shown, is practically always due to the streptococcus pyogenes longus, whether subsequent to acute streptococcal conjunctivitis or to one of the other acute forms; in this instance doses of 100 millions organisms may be begun with, and repeated or increased at intervals best controlled by determinations of the opsonic index, or in default of these, by the clinical appearances.

In conclusion, it must be borne in mind that to secure the best results in eye infections, doses considerably in excess of those, which would be used in similar localised infections elsewhere, must be employed and increased, if necessary, with boldness. The reason for this is probably as follows, the area of infection is small, the blood and lymph flow limited, the resultant amount of toxæmia and of opsonin brought to the part correspondingly small, large doses of vaccine may, therefore, be safely employed, without fear of increasing the toxæmia, to elevate the opsonic index to such a height that adequate opsonin may be brought to these parts.

NOTES FROM FOREIGN JOURNALS.

OPSONINS.

An immense amount of work has been published upon the vaccine treatment of infectious diseases of known ætiology controlled either by laboratory (opsonins) or clinical methods. All the reports have been more or less favourable, but the method of administering the vaccine and the control of the inoculations have varied considerably. The consensus of opinion seems to be leaning towards the impracticability of Wright's method, and to favour the clinical method. From his personal experience with Wright's method of treatment, Ohlmacher (*Journal of Amer. Med. Assoc.*, No. 7) concludes that the proper artificial auto-inoculations will produce results in the constitutional and local improvement in many subacute and chronic infections entirely beyond anything previously possible in medicine; that they are therapeutic agents of a specificity and potency exceeding anything heretofore employed in the treatment of disease, except possibly the antitoxin of diphtheria. Potter (*Journal Amer. Med. Assoc.*, Nov. 30), after a very exhaustive comparative estimation of opsonins due to different organisms, concludes as follows:—(1) Wright's method of indicating the opsonic indices in bacterial infections is hardly accurate enough to compensate for the amount of time involved in its application. There is a general parallelism, however, between the opsonic indices and the clinical course in most cases, so that these determinations should be made when the results of inoculation cannot be controlled by the ordinary clinical methods of observation, when there are several organisms present, and when the patient does not improve from the usual method of inoculation. (2) Its variation depends upon (*a*) difference in normal serum, so that even when the counts varied on the average two, three, or more supposedly normal sera it is not possible to prevent variations of 10 per cent. to 30 per cent.; (*b*) difference depending upon the source of the leucocyte; and (*c*) differences depending upon counting different areas of the same slide. (3) Leucocytes from patients, the subjects of bacterial infections, do not always agree in the phagocytic activity with those from normal individuals. (4) Inoculations of dead cultures of homologous or heterologous bacteria are helpful or curative in many local infections. (5) It is probable that the response to inoculation can be easily exhausted by too large and frequent doses, and it is very doubtful if advanced cases can be completely cured by inoculation.

"Regarding the opsonic index, Trudeau's observations (*Journ. of Amer. Sc.*, 1907) are that, leaving aside the difficulties and sources of error in the determination of the index, as yet it is not established as a reliable criterion of immunity, because opsonins constitute only one of the active bodies produced in immunity reactions. The clinical method aims gradually to produce immunity to tuberculin without any violent or local reaction." —(W. Engelbach, M.D., in *Inter-State Medical Journal*, Jan.)

"The work of Sir Almroth E. Wright on the principles of opsonotherapy has called the attention of many observers to the application of this theory

to the treatment of tuberculous disease of the bones and joints. As Wright (*Journ. Amer. Med. Assoc.*) has stated, it is necessary that those attempting to employ this form of treatment be acquainted with the physiology of the immunising response, that they realise the conditions under which bacteria cultivate themselves in the organism, that they understand under what circumstances bacterial products, or bacteria, as the case may be, are conveyed in the blood stream from local foci of infection. Added to this must be a knowledge of how the organism reacts to such auto-inoculations, and there must be an understanding of the conditions necessary to bring the leucocytes and the bacteriotropic substances which are the instruments of immunisation into operation on bacteria, which are cultivating themselves inside the organism but outside the blood-stream. Ridlon (*Amer. Jour. Ortho. Surg.*, 1907) has made a preliminary report in ten cases of chronic joint disease treated by tuberculin injections after the methods laid down by Wright, and concludes that a low tuberculo-opsonic index with local joint symptoms may be accepted as evidence of joint tuberculosis. But a practically normal tuberculo-opsonic index, together with local joint symptoms, neither proves nor disproves joint tuberculosis. When the diagnosis of joint tuberculosis has been made, a high tuberculo-opsonic index should be maintained, if possible, With a high tuberculo-opsonic index an operation for the removal of all or part of the local disease may be undertaken; not so with a low index. If use of the diseased joint lowers the opsonic index, the joint must be protected; if it does not lower the index, it may be permitted; if it raises the index, it should be insisted upon. General elevation of the temperature following a tubercle injection indicates too large a dose. A persistent lowering of the index during treatment by tubercle injections indicates that the injection has been given at the wrong time, during what Wright calls the negative phase, instead of during the positive phase."

R. Tunstall Taylor and E. A. Knott (*Amer. Jour. Ortho. Surg.*, 1907), working on this subject, have drawn the following conclusions:—That the question of the size of the dose is important, and the opsonic index is the best guide to this, showing at once an overdose, and when vaccination is given at too frequent intervals, which no other clinical means will show. They offer, as supplementary means to register the progress of the cases subjected to this form of treatment, the arc of the X-ray to note the changes, if any, effected by vaccines or tubercle injections upon the disease foci in the bones.

Jeans and Sellard (*Johns Hop. Hosp. Bull.*, 1907), have studied nine patients treated by means of tuberculin of their own preparation, observing the tuberculo-opsonic indices of each patient, and conclude that the patients are too few for any general conclusion to be drawn. Other dosage and other interspacing of dosage might have been more effective, and, perhaps, other forms of tuberculin might have given better results. They are of the opinion that the clinical result and not the opsonic curve is the standard to judge improvement.

Though results have been far from positive and the technique and laboratory equipment necessary to carry out these various means of treatment are quite elaborate, it seems, from what has been attained, that we are on the edge of a great scientific advancement. There is, perhaps, some

truth, on the other hand, in the statement made by Watson Cheyne, that "in joint and bone diseases, where no operation would formerly, or now, have been considered necessary, by all means add the use of tuberculin to other methods employed. But blindly to convert the practitioner into an immunizator, as Professor Wright puts it, is, I believe, a totally retrograde step." (Nathaniel Allison, M.D., in *Inter-State Medical Journal*, January.)

"The opsonic theory is based on the assumption that leucocytes combat infection by enclosing them phagocytically, and thus keeping them away from cells susceptible to their action. It is Metchnikoff's old idea, but it has been placed in the background by the modern immunity investigations by reason of exact demonstrations of other processes that produce immunity. Wright's assertions, based on a method that, to the critical investigator, is full of great sources of error, and not based on any definite knowledge of the nature of phagocytosis that certainly exists, should have been, from the beginning, more thoroughly controlled and refuted. It was the beguiling ease with which an object could be achieved, and had previously resisted other ways to deal with it. The fact that in any blood there are present substances that affect infectious bacteria in a way to enable the leucocytes to take them up by phagocytosis, is not original with Wright; it had been stated long before, and at the same time was submitted to thorough investigation by Neufeld and Rimples. Under the name of bacteriotropic substances they were added to the manifold constituents of the blood. What their object and nature were could not be discovered. Wright, we must admit, independently took it up, and following a method worked out by Leishmann, modified it so that seemingly it was brought into a condition to be studied and dealt with in a similarly exact procedure as obtains for the immunity substances. His idea was that the leucocytes in infection had the task of destroying bacteria; that in any infectious condition the increase of the phagocytic activity was an attempt at elimination of the bacteria and conditioned by an increased quantity of those bacteriotropic bodies to which Wright gave the name, opsonins. Comparative observations seem to show that in normal blood the opsonins are present on the average in about the same quantity, but under pathological conditions the latter varied greatly, and was, as a rule, lower than in health. The relation between these quantities in his opsonic index. To increase the index, to bring it above the normal, appeared to him to increase the chance for eliminating the infection; in fact, he gradually came to consider the work of the opsonins the only factor to be considered in combating infections. Naturally it suggested itself to him that a way to do this would be to use the addition of killed bacteria to those living in the affected individual; he used, therefore, the old method of bacterial inoculation for the purpose. In making injections of these, he soon observed a rise of the opsonic index, and likewise an improvement of the pathological condition. He read out of the curves of the opsonic index a direct agreement between its value and the condition of the patient. The inoculations were regulated in time and amount according to this index. The results obtained by him and by many enthusiastic followers, some with great reputations as authoritative men, were good, exceedingly good in many cases; especially many cases of skin infection that had resisted the efforts of dermatologists for years yielded to this opsonic treatment. A great era of successful scientific treatment of as

yet unmanageable troubles, was foreseen, and, in England and our country, opsonins were the all-absorbing subject of admiration and of work, following exactly and with no criticism the work of the master. Even Simon, of our country, although critically understanding the flaws in Wright's method, and supplanting it with a somewhat more exact procedure, took hold on the importance of opsonins. The trouble is, we do not know what they are, how they act, and what meaning phagocytosis has. In Germany there was a great silence about the new discovery; a silence caused by the clear understanding that the basis of Wright's theory was nothing but preconceived assumption. The results of opsonic treatment were surprising only to men not conversant with their nature. The results like those glowingly reported have nothing to do with the 'opsonic' treatment, but are only an effective, active immunisation of the patient against his own bacteria. Even the opsonic curves, taken after treatment, prove this. After injection the opsonic curve shows a fall (negative phase), to rise again above the initial height or higher; after a few days it begins to grow lower until an injection again drives it higher, perhaps above the highest point reached before. If at this time the treatment is stopped, the curve will return to its former height and stay there. If the treatment is continued for weeks and these variations of the line of the curve do not appear so pronounced any more, the infection is killed. Now, let us compare this behaviour of the opsonic curve with that of the anti-body curve that begins low at the normally present amount of anti-bodies in the body. It shows a negative phase at the beginning of the infection; but if the system is not overwhelmed with the intoxication, commences to rise and reaches its acme about the twentieth day, that is, the time when re-convalescence is beginning. It remains steady for a long time and only very gradually disappears after months or even years. Here, we know with what substances we have to deal; we know exactly the character of the reaction down to its quantitative proportions. Wright deserves credit for having called to our attention, by practical application, the value of using bacterial material for dealing with chronic infectious processes; it is a crime, scientifically proved, to use it in the acute infections if not in the most early stages, that are hard to diagnose.

"Aside from this statement there is something that must not be forgotten in the opsonic treatment and theory. Anything that pretends to bear scientific character must have those qualities that are the innate nature of science.

"The methods by which new theories are arrived at must conform with those held as obligatory by science. That is not by any means true of Wright's method. It is the most empirical that can be imagined; there is no control for any step. It is, furtnermore, so much subject to the influence of the personal equation of the observer that a uniformity of results is absolutely excluded. A normal opsonic index does not exist, and we have no means to determine what the normal condition should be. Therefore, conclusions from such an index in disease are not justified. The opsonins will continue to be investigated, and it may be that important functions of their activity may be discovered. As yet they are things that we know exist, but of which, up to now, we have no thorough understanding. Their alleged effect in chronic processes bacterial in

origin, is due altogether to other reactions than those of opsonins." (Carl Fisch, M.D., in *Inter-State Medical Journal*, Jan.)

Pigger has observed astonishingly good results from Brauer's method of inducing artificial pneumo-thorax in a series of cases of one-sided tuberculosis. The opsonic index was determined in five cases, and showed that, on the whole, the opsonins contained in the blood were increased by the artificial pneumo-thorax, and, in cases in which complete compression of the lung was obtained, the normal remained higher after preliminary to-and-fro movements.—*Brauer's Beiträge zur Klinik der Tuberculose.*

Stocker, of the Surgical Clinic at Bonn, has an article in the *Correspondenz-Blatt f. Schweizer Aertze*, in which he describes Wright's methods of procedure, and goes on to say that the method explains why tuberculin-injections, as given by Koch, exhibit such different results, seeing that a fresh injection given during the negative phase is harmful, while one given in the positive phase is of the greatest benefit. The best results have been obtained in tuberculosis affecting the bones. The method will not obtain its beneficial action without surgical interference, but conservative operations will be effectively assisted. In occluded foci, from which the blood is almost, or entirely, cut off, there will be no direct effect by increasing the opsonic index, but, as the general condition improves, the focus will be gradually affected by the increased circulation.

Hans Much, Director of the Department of Experimental Therapeutics in the Eppendorfer Hospital, publishes, in the *Münchener medizinische Wochenschrift* of March 10th and 17th, a long paper containing some of the results obtained by him, jointly with Professor Lenhartz, from investigations into opsonins. He looks upon the determination of the opsonic index as a valuable aid in diagnosis, as it will afford a result when all other methods fail. The investigations published have been chiefly concerned with the typhoid bacillus and the paratyphus B., but the staphylococcus and the streptococcus are also dealt with. The question of the pneumococcus is under investigation by Lenhartz and himself, and their results will be published later, as well as some further cases of puerperal fever, in which the opsonin method was carried out. It opens out to the obstetrician a wide prospect of usefulness.

The action of opsonins upon bacteria, and their rôle in the process of phagocytosis is beyond all doubt. But that is far from saying that leucocyte-phagocytosis is, or is not, intrinsically an effective prophylactic of the organism, or generally the categorical prophylactic against morbific bacteria. From the shape of a cell, which is crammed full of micro-organisms, absolutely no conclusion can be drawn as to the vitality or non-vitality of the germs concerned. On the strength of his researches so far, Much inclines to the opinion that phagocytosis, as such, hardly approaches the part as the bactericidal agent in the struggle of the organism against the exciting cause of disease. At the most, it appears to him to be a signal, and not a weapon in this struggle.

Notes by the Way.

Our New Building.

OUR readers may or may not be aware that our offices and stockrooms suffered, some time ago, from an incursion of what the old-fashioned reporters used to call "the devouring element"—fire. We were obliged, in consequence, to seek temporary premises elsewhere, and make provisional arrangements for continuing business from very cramped and inconvenient headquarters. In France they say "it is only the provisional that lasts"; but this is not to be the case with us. We are happy to be able to announce that we have secured new premises, and shall take possession of the whole building as soon as the workmen have taken their departure. Further details will be shortly announced.

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Bacteriology.

THE rapid progress in medical science which has taken place within recent years has evolved many new methods in both the diagnosis and the treatment of disease. Many of these new methods, although based upon scientific research and conducted in scientific laboratories, have proved to be of enormous practical value to the medical practitioner. Chief amongst the sciences to which these satisfactory results are due must be placed bacteriology, the youngest of the sciences auxiliary to medicine. By virtue of its practical applications to all branches of medical science, bacteriology now occupies a place of the first importance in the work of the practitioner in every branch of medicine. There are many who can well remember the beginnings of this science, chief amongst which were the researches of Pasteur into the bacteriology of putrefaction, the direct outcome of which was Lord Lister's work on anti-septics, the value of which in surgical treatment cannot be over-estimated. It is not too much to say that antiseptics and anæsthetics together have combined to render the brilliant successes in modern surgery possible, and

the logical replacement of antisepsis by asepsis has done even still more for the advancement of surgery.

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Serum Reactions.

As an aid to exact diagnosis, and therefore to rational treatment, bacteriology has also acquired an importance, not merely by finding the various micro-organisms which cause the several diseases, but also by demonstrating such specific serum reactions as that provided by the agglutinins, as, for example, in the well-known Widal reaction in the diagnosis of enteric fever. It is not necessary to insist on the aid which has been rendered by bacteriology to the prophylaxis and the prevention of disease. The more thoroughly the causes of various diseases are known, the more accurately and certainly can methods for their prevention be undertaken.

* * * * *

Immunity.

The behaviour of the human organism in the presence of infective agents is very variable, depending largely upon the degree of immunity possessed by the individual. By the term "immunity" is understood the non-susceptibility of the body to a disease or to the invasion of an organism. The circumstances in which this may occur are either under natural conditions, or under conditions which have been brought about as the result of experimental procedures. In cases where this non-susceptibility is possessed naturally, we speak of a *natural* immunity, in contradistinction to *acquired* immunity which results either naturally, or as a consequence of passing through an attack of the disease, or artificially as the result of inoculation. Artificial or acquired immunity may be active or passive according to the method employed in its production. Broadly speaking, *active* immunity is produced by an injection, or a series of injections, of non-lethal doses of an organism or its toxins, whilst *passive* immunity is produced by the injection of the serum of a highly immunised animal. Such a serum may be *antitoxic—i.e.*, from an animal highly immunised against a particular toxin, *e.g.*, the diphtheria antitoxin—or *antibacterial—i.e.*, from an animal immunised against a particular bacterium in the living and virulent condition. In

active immunity, the immunity is produced comparatively slowly, but lasts a considerable time; whereas in passive immunity the immunity is produced rapidly and as rapidly passes off. It is to the methods of active immunity that we are indebted for the procedures of preventive inoculation or vaccination, the vaccines being emulsions of the various organisms usually killed by heat, or by their toxins. The effects of the injection of the vaccines are then observed by means of their "opsonic index."

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The "Opsonic Method."

THE practitioner who is not a trained pathologist, and who has read the various articles in this issue of THE PRACTITIONER, will probably ask, What, exactly, is the practical value of the *opsonic method* as it stands to-day? He will probably obtain different replies from different sources. The enthusiast may lead him to believe that the method forms a panacea for all the infectious diseases, whilst another may deny that it is of the slightest value. The truth, no doubt, lies between these two extremes. In the case of tuberculous infection, the method, on the whole, has been somewhat disappointing, though many striking cures have been obtained, and we hope that the future will lead us to a better recognition of the class of case likely to be benefited by this particular method of treatment. At present we are justified in concluding that the method cannot do harm and certainly may do good. It should undoubtedly be tried in those cases in which its use does not interfere in any way with the employment of other methods; but in those cases where surgical means are indicated, and are likely to be efficacious, there should be no delay in order to employ vaccine-therapy. Where, however, no other methods are applicable, as, for instance, in cases of tubercular disease of the iris, or where for any reason the surgeon wishes to wait a while before operating, the method is certainly indicated. In the case of the other infectious diseases, the results have been, on the whole, decidedly more encouraging. This is particularly the case with staphylococcic infections of all kinds; here the vaccine method should be regarded as the chief of all therapeutic measures. In the more chronic lesions due to pneumococci, gonococci,

especially in gonorrhœal arthritis, the new process is one of great value and should certainly be tried. It is true, simpler methods may be used first; but, should they fail, the opsonic method is surely indicated.

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A Word of Warning.

THE method is a new and complex one, and, until its use has been more thoroughly explored, it should only be carried out under the guidance of an expert. In the enthusiasm begotten of the introduction of a new process, there is always the possibility of too much being attempted, and, if practitioners in general act on the notion that they have only to obtain so many millions of bottled bacteria and to inject them into their patients, the process is doomed, and we shall have another fiasco similar to that which followed the first introduction of tuberculin. When Lord Lister introduced the antiseptic technique he dressed many of his hospital patients daily for months with his own hands; he was demonstrating the value of the method, and a failure due to carelessness or inexperience of anyone else would have tended to discredit it. Whether an opsonic control of the injections will always be necessary still remains to be shown, but for a long time yet the exhibition of the vaccines should be preceded by a most careful bacteriological examination, and, if possible, the particular vaccine should be prepared for each individual patient. If these precautions are taken, there is little doubt that the opsonic method, and vaccine-therapy, has a brilliant future before it; at present, however, it is certainly in the experimental stage, and should be so regarded.

Preparations, Inventions, etc.

TUBERCULIN FOR HYPODERMIC USE.

(Messrs. Allen and Hanburys, Ltd., 7, Vere Street, W.)

This is the "new" tuberculin (T.R.), and is put up in sterile glass capsules ("azoules"), ready for injection. The capsules contain 20 minims of dilutions of various strengths which have been sterilised for one hour at 60° C., so that the fluid only contains a suspension of bacillary substance in a minute state of subdivision. The doses are still calculated on the basis of each c.c. containing 10 milligrammes of solid substance, the earlier but erroneous calculation, the actual amount being 2 milligrammes. The "old" dose and the actual amount are given on each capsule. The contents of these azoules are easily transferred to the syringe for actual use. The dilutions keep good for several weeks.

THE OPHTHALMO-REACTION.

(Mr. W. Martindale, 10, New Cavendish Street, London, W.)

We have received from Mr. Martindale samples of tuberculin in the liquid form, which have been prepared for the diagnosis of tuberculosis in man by the ophthalmo-reaction introduced and described by Calmette. The test is as follows: One drop of the liquid tuberculin is placed into the conjunctival sac, near the inner canthus of the eye, and the eyelids are kept apart for a minute. If the patient is tuberculous, the maximum reaction appears in from 6 to 12 hours after instillation of the tuberculin, and this consists of a redness of the lower palpebral conjunctiva, swelling of the caruncle, with epiphora; there is practically no pain. No reaction occurs if the patient is a non-tuberculous one.

We do not consider the test so absolutely diagnostic of tuberculous disease as has been claimed for it, for it is our experience that a patient may be tuberculous and yet give no local conjunctival reaction. The test, too, is not completely free from danger, and we consider that it should be used only by those who have had some experience in dealing with diseases of the eye. A dry form of tuberculin is also supplied

which may be readily dissolved in distilled water; each powder contains sufficient for ten trials.

TUBERCULIN FOR THE OPHTHALMO-REACTION.

(Messrs. Allen and Hanburys, Ltd., 7, Vere Street, W.)

This is a solution of the solid matter of "old" tuberculin, specially made glycerine-free for the purpose of Calmette's diagnostic test for tubercle. The glass-tube, containing 0·5 c.c. of a ·5 per cent. solution, is furnished with a rubber-bulb for ejecting the drops into the eye after breaking off the ends. It is a very convenient arrangement, and has the additional merit of being inexpensive. The name of the makers is a sufficient guarantee for quality and accuracy in strength. Full directions and a description of the positive reaction accompany each tube.

BACTERIAL VACCINES.

(Messrs. Parke, Davis & Co., 50, Beak Street, W.)

These vaccines are prepared in the vaccine laboratory of the department for therapeutic inoculation at St. Mary's Hospital, Paddington, under the direction of Sir Almroth Wright, F.R.S. They consist of bacterial cultures, sterilised and standardised, so that each c.c. contains a specified number of microbes, or, in the case of the tubercle vaccine, a specified weight of the powdered tubercule culture. They are put up in glass bulbs, each of which contains a little more than 1 c.c. of the vaccine, from which it is easy to draw the required amount into the inoculating syringe. Five vaccines are prepared, the staphylococcus vaccine—in three strengths, containing 100, 200, and 500 millions of staphylococci per c.c.; the streptococcus vaccine, in two strengths, containing 5 and 10 millions per c.c.; the gonococcus vaccine, containing 5 millions gonococci per c.c.; the tubercle vaccine, in two strengths, containing 1·2000 and 1·5000 of a milligramme of powdered culture per c.c.; and the typhoid vaccine, in two strengths, containing 1000 and 2000 millions of bacilli per c.c.

BACTERIAL VACCINES AND OPSONIC OUTFIT.

(Mr. W. Martindale, 10, New Cavendish Street, London, W.)

We have received from Mr. Martindale a selection of bacterial vaccines prepared by the Wimpole Institute ready

for use. They include streptococci, staphylococci, gonococci, Friedlander's bacillus, pneumococci, B. coli, and others, and various dilutions of the tuberculins. They are said to be prepared from bacteria of the highest virulence, and, accordingly, to possess a maximum of therapeutic agency. It is somewhat doubtful whether this contention can be maintained, since the *suitable* vaccine to use in a given case is one prepared from the organism which causes the infection, whatever its virulence, and, in any case, it would seem that the only advantage obtained from using a virulent culture would be that a smaller dose would be required.

Exception may be taken to some of the statements with regard to the use of the vaccines. It is claimed, for instance, that "a series of injections (of gonococcal vaccine) will certainly free any case of chronic gleet from all suspicion of gonococcal infection." This is a sweeping and most astonishing statement. If true, it is of the highest importance and worthy of being substantiated by the fullest evidence; if erroneous, it is one that may lead to most disastrous results. We think, too, that the advice to use streptococcal vaccine in such affections as septicæmia, puerperal fever, and "endocarditis" should be accompanied by some warning of the possible dangers of the method and the contra-indications, and some suggestion of the fact that no benefit is likely to result, unless a bacteriological examination has demonstrated the streptococci nature of the disease. The statement that the vaccine maintains its efficiency for an almost indefinite period is one which may be doubted. Some bacteriologists believe that the vaccines lose their potency in a comparatively short time, and, in any case, the method is too new for their efficacy to have been proved to last for very long periods.

Another vaccine is directed against "colds," and is directed to be given every three months, the nose being douched out daily with an antiseptic lotion. Its constitution is not given.

Mr. Martindale has also forwarded for our inspection an outfit to enable medical men to collect specimens of blood for determination of the opsonic index. Although it appears to us to be rather bulky, it is well designed, and should prove useful.

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THE PRACTITIONER.

JUNE, 1908.

PROGRESSIVE MUSCULAR ATROPHY.[1]

By GUTHRIE RANKIN, M.D., F.R.C.P. (Edin.), M.R.C.P. (Lond.),
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In dealing with the subject of Infantile Paralysis some time ago (The Practitioner, February, 1908) we had before us an example of a disease of acute onset, almost wholly confined to children, and dependent upon a vascular lesion of the ventral horns of the spinal cord. Now I draw your attention to another disease of the lower motor segment of the nervous system, which is very chronic in its development, commences in adult life, and has for its pathological substratum a slow and gradual destruction of the multipolar nerve cells in the anterior horns of the cord. The seat of lesion is the same for both these disorders, but the disease-picture in them greatly differs.

Progressive Muscular Atrophy is otherwise spoken of as Wasting Palsy, or Poliomyelitis Anterior Chronica. This latter name, however, does not correctly describe the disease because the morbid process may not be wholly confined to the anterior horns, but may affect the lateral columns as well. There are really three affections, usually described separately, which all belong to the same category of disease, viz.:— progressive muscular atrophy of spinal origin; amyotrophic lateral sclerosis; and bulbar paralysis. An atrophic change in the motor neurones is primarily responsible for all three varieties. In simple muscular atrophy, the lesion is confined to the anterior horn cells and their axis-cylinder prolongations to the muscles. In amyotrophic lateral sclerosis, there is an additional implication of the cortical cells and their axis-cylinder prolongations into the lateral columns; and, in bulbar

[1] A lecture delivered at the London School of Clinical Medicine, Greenwich.

paralysis, there is involvement of the motor nuclei in the medulla oblongata. It often happens that each of these varieties is manifest in the same case; the illness, which at first bore only the characteristics of progressive muscular atrophy, may develop, at a later period of its progress, spasm increased reflexes, and other evidences of degeneration in the pyramidal tracts; and ultimately terminate with all the usual phenomena of a glosso-labio-laryngeal paralysis.

The first description of Progressive Muscular Atrophy, as a distinct type of disease, was made by Aran, and, at a later date, typical cases were recorded first by Duchenne and afterwards by Cruveilhier. Lockhart Clarke discovered that the muscular wasting was associated with changes in the multipolar cells of the spinal anterior horns, and Charcot subsequently elaborated Clarke's original observations.

The cause of the disease is unknown. It occurs more frequently in men than in women, in the proportion of about three to one, and it very seldom declares itself before the thirtieth year of life. The muscular atrophies, met with in children, are, in the large majority of instances, myopathic. It is most common among those who have a neuropathic heredity, but direct inheritance is rare. It occurs in all classes of society. Overwork, worry, exposure, and traumatic injury to the back have each and all been credited with its immediate causation. The cases which come under observation in this hospital, lead us to believe that excessive muscular effort, combined with exposure, is a frequent exciting cause, especially in those who have suffered from syphilis. The rôle played by syphilis, as an ætiological factor, is not definitely ascertained, but it may be certainly regarded as a powerful predisponent. The onset of the disease is not attended with any constitutional disturbance. The characteristic atrophy, which mostly begins in the small muscles of one hand, has usually become definitely established before the patient's attention is arrested by the loss of power and the difficulty in performing delicate manipulations which ensues. Occasionally, but seldom, myalgic pain accompanies the atrophic process. In the patient now under consideration, these pains were such an unusually marked feature of the illness that the question was raised as to whether some

element of multiple neuritis did not enter into his case. According to Gowers, some cases are met with in which symptoms present "every gradation to subacute poliomyelitis in one direction, and perhaps also to polyneuritis in another;" and others where "muscular atrophy in the arms is accompanied by the symptoms of locomotor ataxy in the legs." The muscles of the thumb are the first to suffer, as a rule, then follow those of the hypothenar eminence and the interossei. Marked depressions become established over the ball of the thumb, the heel of the hand, and between the metacarpal bones. Exceptionally, the disease first declares itself in the deltoid, or in some flexor muscle of the forearm. After a time, the corresponding muscles on the opposite side are liable to undergo similar changes, but the atrophy may for long remain limited to one arm, and its neighbour may never become seriously implicated. In a small minority of cases, the atrophy begins in the lower extremities, and occasionally some of the trunk muscles are early affected. The disease gradually extends to one muscle after another, until eventually almost all the muscles of the arm and many of the trunk participate in the degenerative process.

Beevor points out that the progression of invasion is usually as follows:—"After the interossei and the small finger muscles, the disease, as a rule, attacks the flexors of the fingers, and then the flexors of the wrist before the extensors of the fingers, thumb, and wrist. Almost simultaneously with the thumb muscles, or soon after them, the deltoid begins to waste, and is followed by the supra and infra-spinati, the biceps, the brachialis anticus and the supinator longus. The last muscles to be affected are the latissimus dorsi, the lower half of the pectoralis major, and the triceps." The clavicular part of the trapezius muscle seems to be peculiarly invulnerable; so much so that Duchenne referred to it as *ultimum moriens*. The extensor muscles of the neck may suffer considerably, when there results a difficulty in supporting the head erect upon the spine. The facial muscles almost invariably escape the general atrophy, though the lips may become flabby as part of the bulbar paralysis which so often sets in late in the disease. Wasting in the legs is much less common than in the arms and, when it occurs, is less pronounced, but, in exceptional

instances, the disease first manifests itself in the legs, and is more intense in them than in the arms. Such cases are often spoken of as the neuritic form or peroneal type of muscular atrophy.

The muscles of respiration ultimately suffer in the majority of cases, and their impairment constitutes a grave source of danger. The muscles of the abdominal wall waste far less frequently than those of the thorax. Various forms of spinal curvature are liable to follow the involvement of the trunk muscles. The atrophy of the interossei muscles produces the peculiar claw-like shape of hand—the main-en-griffe of Duchenne—with which we are all familiar. As muscular wasting progresses, the adipose tissue also shrinks, and an extreme degree of attenuation is sometimes reached. The living skeleton of the showman's booth is generally the victim of this disease in its advanced stage. The debility of the muscles, which have become atrophied, is proportionate to the amount of wasting they have undergone. The muscles are not generally tender to pressure. This last point is of importance as a diagnostic distinction from multiple neuritis, in which disease there is also marked muscular wasting. Fibrillary tremors are a striking feature of the wasting muscles. The electrical reactions are a varying quantity; in the early stages, there is nothing more than a diminution of response to both forms of electricity, but, gradually, an imperfect, and finally a complete, reaction of degeneration is obtained. The explanation of this, of course, is that though some motor nerves are at once destroyed, others remain for a time more or less active, and are capable of response to faradic stimulation; and similarly, since the muscular fibres are destroyed seriatim and not *en bloc*, a partial response to the continuous current is possible so long as any fibres remain unaffected. In the myopathic forms of muscular atrophy, fibrillary twitchings and the reaction of degeneration are not met with.

The condition of the reflexes is variable. The reflexes, passing through any spinal segment, are only abolished when all the nerve cells in that segment are destroyed, but, in this disease, the destruction of the multipolar cells is rarely complete, at least until the later stages, so that reflex contractions—though often feeble,—can, in the earlier stages, still be elicited.

Moreover, it is only the reflexes connected with the affected segments that suffer, and, since the lumbar enlargement is not usually the seat of lesion, the reflex movements in the lower limbs are not interrupted. Indeed the knee-jerks are mostly exaggerated, and this exaggeration is in time accompanied by ankle-clonus, Babinsky's sign, and spasticity of the legs. These are the cases in which the lesion has not remained confined to the spinal cells, but has involved the cortical cells as well, and induced degenerative changes in the lateral columns. In the advanced stages, a chin-clonus can often be obtained. The sensory functions in this disease remain intact, though the patient may complain of numbness and coldness in the affected limbs. Optic nerve atrophy never occurs. Bladder and rectum both continue normal. As a terminal trouble, after the patient has become bedridden, incontinence of urine and bedsores are of common enough occurrence, but they are not distinctive features of the disease, which confines its ravages entirely to the motor side of the nervous mechanism. As time goes on the patient becomes emaciated, but the general health remains good until a very late period of the illness. The urine ought to be examined, from time to time, for sugar, whose presence is sometimes the earliest indication of an extension of the disease to the bulbar nuclei.

The tendency of Progressive Muscular Atrophy is to advance slowly and uninterruptedly over many years, but, in some cases, its progress is rapid, and to be measured by months rather than years, whilst in others it seems to become arrested after reaching a certain point of development. Death is mostly due to the occurrence of an organic disorder independent of the nerve lesion, but, in many cases, it is the direct result of an extension of the disease to the bulbar centres in the medulla. When the lateral columns become involved in the degenerative process, we get presented to us the picture described by Charcot as Amyotrophic Lateral Sclerosis, the leading features of which it may be convenient to epitomise. The pathological lesion consists in a sclerosis of the lateral columns, together with destruction of the multipolar cells in the anterior horns. The symptoms are, at first, confined to the upper extremities, and comprise weakness,

fibrillary twitchings, electrical changes, and atrophy similar to that met with in the Aran-Duchenne type of progressive muscular atrophy. This is followed by rigidity and increased myotatic irritability in the lower extremities. A jaw-clonus is often a distinctive feature. Later on, the lower limbs are enfeebled, wasted, and invaded by a spastic paraplegia, but there is no disturbance of sensation and no impairment of bladder or rectum. Contemporaneously, the atrophy in the upper limbs increases. Finally, the motor nerve cells of the medulla oblongata become affected, just as is so frequently the case in the simple anterior horn type of the disease, and the ordinary symptoms of bulbar paralysis—which comprises defect in speech, wasting, and fibrillary tremor of the tongue muscles; salivation, prominent and everted lips, difficulty in deglutition, and feebleness of voice,—are the preclude to death.

Gowers gives the following classification :—

(1) Atonic atrophy, which may become extreme.

(2) Muscular weakness with spasm, but with only slight wasting.

(3) Tonic atrophy, with exaggeration of reflexes.

He says :—"These conditions may co-exist, in every degree and combination, between universal atonic atrophy on the one hand, and universal spastic paralysis without wasting on the other, there is every gradation."

As regards the pathology of the disease, it may be differentiated, as the variation in symptoms would lead us to expect, into two varieties :—that in which the degeneration in the anterior horns is the only lesion found, and that in which there is, in addition, indication of a lesion in the crossed pyramidal tracts. The two run into one another, and many authorities, as has been already stated, regard the lesion in the pyramidal tracts as coincident with, or sequential to, but produced by the same cause as the lesion in the ventral horn. Gowers believes that "the only adequate explanation of the facts is that the degeneration of the upper and lower segments is simultaneous, or if not simultaneous, at least so far independent that neither is the cause or consequence of the other ; both are the results of the same tendency to degeneration of the motor path." The essential morbid

change, found in the spinal cord, is a slow and gradual destruction of the multipolar nerve cells; with, in addition, in most cases, evidences of sclerosis in the lateral columns. It is difficult to determine whether the morbid change in and around the nerve cells is degenerative or inflammatory in character; both theories have their adherents. The lesion is not diffused throughout the cord, but is confined to certain definite regions; its starting point is most frequently the lower cervical or upper dorsal segments. It is important to note that all the nerve cells in the affected segment are not simultaneously attacked. The lesion picks out some, and, having crippled or destroyed them, passes on to attack neighbouring cells. Months or years may elapse before all the multipolar cells of the involved area are implicated. The consequent muscular weakness and atrophy are gradually developed;—a remarkable contrast to the sudden and maximum palsy, which is declared as almost the first event in acute anterior poliomyelitis.

Another important point of distinction between these two disorders, to which passing reference may be made, is that whereas progressive muscular atrophy mostly attacks the cervical enlargement, "slowly destroying nerve cell after nerve cell," and tends to spread from segment to segment of the cord, until it may even involve the multipolar cells of the medulla, in acute anterior poliomyelitis, the lumbar is much more frequently attacked than the cervical enlargement, and the lesion remains limited to the segments first implicated. To the naked eye, the cord from a case of progressive muscular atrophy may present an obviously wasted condition of its anterior aspect, and its substance is often softer than it should be. Microscopically, the nerve cells are shrivelled, their processes are diminished in number, and they frequently contain an excess of pigment; the intervening neuroglial tissue is increased, and the connective tissue cells are enlarged. There is distinct degeneration of the anterior root fibres, whole bundles of which appear to be replaced by fibrous tissue. The atrophied muscles are pale, and are sometimes almost indistinguishable from adjacent fat. In advanced cases, it is found microscopically that transverse striation has disappeared, and that the muscular fibres are infiltrated with fatty globules,

while the spaces between them contain an excess of connective tissue.

The posterior horns and posterior roots are always healthy, but, in many cases, the lateral columns are sclerosed up to different levels, or even the whole length of the cord, through the internal capsule, and up to the cortex, the cells of which have been found degenerated. In cases, in which there have been bulbar symptoms during life, similar degenerative changes to those described in the anterior horn cells are found in the motor cells of the medulla oblongata.

The prognosis of progressive muscular atrophy, is, in most cases, good as regards duration, but hopelessly bad as regards recovery. In some instances, the disease becomes arrested, but, in the majority, its progress is persistently downhill. When arrest does take place, it usually happens only after a large number of muscles have become atrophied and more or less useless. If the diaphragm or intercostal muscles are involved, the gravity of the prognosis is increased. It becomes very seriously augmented when bulbar symptoms supervene. These, though mostly a terminal event, sometimes declare themselves comparatively early in the history of the illness. The presence or absence of other associated lesions in the cord must also be taken into account in estimating the probabilities.

In typical and fully developed cases, there is no difficulty about the diagnosis. The chronic and insidious onset ; the muscular wasting and co-equal loss of power ; the progressive character of the disease ; the fibrillary tremors ; the electrical changes in the atrophied muscles ; the absence of sensory disturbances and of any bladder or rectal troubles constitute a constellation of symptoms which can cluster round one morbid lesion only. Sometimes, in the earlier stages, difficulty arises in differentiation between progressive muscular atrophy and ulnar nerve paralysis, but careful observation will soon prove that the latter has associated sensory symptoms, and is a localised condition for which frequently a traumatic cause can be found. Later on, the disease may be confounded with peripheral neuritis ; syringomyelia ; lead poisoning ; or muscular dystrophy ; but, in each instance, patient investigation will unravel initial obscurities, and enable the disorder to be accurately classified.

Like many other nerve disorders, progressive muscular atrophy is very disappointing from the treatment point of view. The best results, so far, have been obtained from the hypodermic administration of strychnine. It may be given in doses of $\frac{1}{50}$th of a grain, increased gradually to $\frac{1}{30}$th of a grain twice or three times a day. The injections should be continued over a period of several months, with occasional intermissions of a week or ten days. Arsenic is also useful, but it is probably less beneficial than strychnine. Nitrate of silver was at one time a popular remedy, but it is not nowadays much resorted to. Where there is a definite previous history of syphilis, mercurials and iodides may be given an opportunity of bringing about some improvement. The state of the general health always demands close attention. An abundance of good and nourishing food, warm clothing, avoidance of undue exposure to inclement weather, and escape, so far as possible, from over-fatigue, either mental or physical, are essential points in the *régime*. Cod-liver oil, quinine, the mineral acids, and the syrup of iodide or phosphate of iron are often helpful tonics. Moderate exercise is beneficial, and, when combined with fresh air and sunshine, does much to maintain functional activity and healthy nutrition.

It is therefore always wise, when practicable, to send patients, suffering from progressive muscular atrophy, out of England to a drier and sunnier climate during the cold months of the year. Massage, electricity, and radiant light baths all play a helpful rôle in treatment; in the use of them, as in that of exercise, it is important to avoid over-doing it. The most that can be expected is that they may hinder the progress of the disease, and maintain the nerve cells and muscular fibres, which are as yet unaffected, at their highest possible stage of efficiency. During the terminal stages, when the patient is confined to bed, care must be taken to prevent bedsores, and any exposure to draught, which might set up bronchial or pulmonary irritation, is to be sedulously guarded against. The treatment now must be wholly devoted to the alleviation of symptoms as they arise, and to the maintenance of the patient's strength and comfort.

A CLINICAL LECTURE ON SUPRAPUBIC PROSTATECTOMY.

By B. G. A. MOYNIHAN, M.B., M.S., F.R.C.S.,
Surgeon, Leeds General Infirmary, etc.

It is only a few weeks ago that I completed my first hundred cases of suprapubic prostatectomy, and in the following remarks the experience gleaned from this series of cases will be given.

And, first, a word with regard to the use of terms. We are all accustomed to speak of "enlarged prostate" when symptoms due to prostatic obstruction are present. But the prostate, which causes those symptoms, may be actually smaller than the normal prostate; the complete prostate after removal may be even smaller than a filbert. Moreover, as Mr. McGill pointed out, in the remarkable paper which he read before the British Medical Association in 1889, the mere enlargement of the gland is not in itself sufficient to cause urinary difficulty. He remarks therein how in a patient, under the care of Mr. W. H. Brown, the prostate was so enormously enlarged that mechanical obstruction of the rectum occurred, yet urine was passed without any difficulty whatever. A giant prostate may offer no obstacle to micturition, whereas a gland actually smaller than the normal may be, by reason of a tiny projection into the bladder, the cause of protracted disability, suffering, and death.

The symptoms which are due to prostatic obstruction are these. A man, usually, though not necessarily, over the age of 50, begins by degrees to notice that he is compelled to get out of bed once or more during the night to pass urine. He is said to have nocturnal frequency of micturition; but that frequency is only relative not actual. If accurate count is taken, it will be found that urine is passed no oftener, perhaps even less often, during the night. But it is an unusual thing for urine to be passed between night and morning, and therefore, when the act of micturition becomes imperative within this period, it compels attention. This nocturnal desire may be the only symptom present for months, or even years, but little by little it is noticed that the intervals between the

demands for relief become lessened, until by day and by night no longer period than an hour, or even half an hour, passes without the urgency to micturate being felt. The patient may notice at times that, on the instant the desire is felt, relief must be given, or that, on the other hand, the act can be started only after some delay, that straining has to be hard and prolonged before urine can be made to flow. In the former instance, as Mr. McGill taught us, a cherry-like valvular enlargement of the "middle-lobe" is probably present; in the latter, a ring or "collar" enlargement surrounding the internal meatus. In the former type the impediment is valvular; in the latter obstructive. Little by little, an incapacity to empty the bladder entirely develops, owing to the formation of a pouch in the base of the bladder behind the prostate. The pouch so formed may be deep and capacious, competent to hold a pint or even more of urine. This pouch is never emptied; its capacity may be measured by allowing the patient to pass urine, and by then introducing a catheter to draw off the "residual urine" as it is termed. The stagnation of urine in this pouch no doubt accounts for the frequency with which stones are found in association with prostatic hypertrophy. A time may come when the patient is quite unable to pass urine; retention may occur suddenly, or may be the last phase in a career of gradually increasing difficulties. When it does occur relief must be had from the catheter. It may be that the catheter has in future always to be passed before relief can be obtained; the patient entirely loses all power of spontaneous evacuation of the bladder. Fortunately, however, as Mr. McGill showed, in contradiction of the opinion of Sir Henry Thompson, this capacity returns in full after the prostatic obstruction has been removed. The passage of the catheter, when repeated, is often the cause of an infection of the bladder; for it is remarkable how little advance the principles of asepsis have made in genito-urinary work, as compared with all other branches of surgery. Cystitis develops, the urine becomes offensive, having often a curiously unpleasant "fishy" smell, and it contains mucus, pus, and phosphates in abundance. The combined result of back pressure and infection upon the kidneys is to cause a chronic interstitial nephritis, or perhaps a more acute inflammatory

disturbance. It is true that a "catheter life" may be led for years, without a trace of infection occurring; but such instances are unhappily only in a small minority.

In addition to these troubles, one even more serious may develop. The most remarkable fact, which has appealed to me in my own series of cases, is the frequency with which carcinoma is found in the prostate after removal. In my first 50 cases, there were seven which were carcinomatous; in the second 50, the examination of which is not complete, there will be at least as many as this; that is to say, approximately 15 per cent. of cases of prostatic hypertrophy, submitted to operation, display the evidences of malignant disease. Two forms are to be recognised, of which mention will presently be made.

The surgical treatment of prostatic hypertrophy is now, chiefly owing to the work of Mr. Freyer, so successful that patients should be advised to undergo operation at an earlier stage of the disease. In my own series of cases, many of the patients have been very seriously ill on account of long-standing and very pronounced cystitis, which has caused an ascending infection of the ureters and kidneys, and they have been greatly reduced in strength, and shaken in nerve from the lack of sufficient sleep. Unless there are definite contra-indications to operation, it is desirable to advise the removal of the prostate in all cases, in which the residual urine is of such quantity that the bladder has to be emptied every hour or two, for the frequent interruptions in the night's rest tell very much upon old men. When catheterism becomes repeatedly necessary, infection is almost certain to come, sooner rather than later, and recourse should be had to operation in preference to the "catheter life." In the not infrequent cases in which a calculus is present, operative treatment is doubly indicated. Finally, it is necessary to bear in mind the frequency with which malignant changes are found in prostates, which exhibit the evidences of long-standing changes of an adenomatous, and therefore simple, character. The carcinomatous invasion is a late occurrence, and is therefore surely to be prevented by early removal of the affected gland.

When a decision has been made in favour of operation, the question arises as to the method by which the gland

should be removed. There are two routes used for this purpose, the suprapubic and the perinæal. We, here in Leeds, influenced no doubt by the teaching and the practice of Mr. McGill, have always adopted the suprapubic operation, not exclusively, but certainly from a very confident conviction that it is the better way. The perinæal method, however, it is only fair to say, is preferred by many surgeons of experience, and the results of no surgeon in the world can be compared with those of Dr. H. H. Young of Baltimore. He has recorded a total mortality of 7 in 238 cases, and a consecutive series of 112 cases without a death. There is nothing approaching that in the records of suprapubic work. Still, I have found the suprapubic method so simple, and the final results so satisfactory, that, with the experience I have, I feel that personally I am safer with that than with the perinæal operation.

The first suprapubic prostatectomy done in England was performed on March 24, 1887, by Mr. McGill. In that operation, and in many subsequent ones, he removed only a small portion of the prostate in one piece, or in many pieces; cutting away the projecting and obstructing parts of the gland with scissors. Later Mr. Jessop introduced his "ring-scissors," which made this piecemeal removal of the gland an easier matter. The first attempt at enucleating a portion of the prostate in Leeds was made on December 15, 1887, by Mr. Edward Atkinson. This was during my house surgeoncy, and I quite well remember the enthusiasm the genial operator had for the case, and the simplicity of this procedure. On December 17, 1887, Mr. McGill employed this method of enucleation; "a portion of the prostate, weighing 2 oz. 40 grs., which surrounded the urethra laterally and below, was enucleated in one piece." The specimen in this case (Leeds Museum, F. 150) has recently been photographed by Dr. Cairns Forsyth, and reproduced in the *British Medical Journal*, May 11, 1907, page 1111. It has been on our museum shelves for 20 years; and it shows that in this case exactly the same operation was practised as that which we perform to-day. The specimen consists of the two lobes of the prostate, enclosing the urethra, of which about 1 inch has been removed. It was no doubt as a result of the esson learnt from Mr. Atkinson's case and his own, that

Mr. McGill wrote, in 1889, "the prostate should be removed as far as possible by enucleation with the fingers and not by cutting." The paper which Mr. McGill presented to the British Medical Association, in 1889, is one which you would do well to read. It is the most characteristic, the most authentic of all his writings. If the series of the specimens, placed in the museum by Mr. McGill, are examined, it will be seen that his method altered by degrees as experience increased. In the earlier operations very small fragments of the gland were removed, then larger portions were snipped away with the scissors or the prostate forceps. Some specimens, removed a little later, show masses which have been enucleated, and one (F. 143) consists of probably the greater part of the gland which has been stripped away in separate masses. One specimen only shows the entire prostate removed in one piece with the urethra. It is, perhaps, a matter for wonder that, after the introduction of so striking a procedure into surgery, the method was allowed to fall into disuse. The reason doubtless was that other methods, of less risk (which was at once obvious), and of less value (which time alone could prove), were suggested. The removal of one or both testes, the excision of a portion of the vas deferens, the division of the spermatic cord, were all suggested as means whereby an atrophy of the prostate could be caused. Whether any of these procedures would have claimed attention, had Mr. McGill lived to continue his work, is, perhaps, doubtful. The loss of Mr. McGill, in the year 1890, after months of illness was, indeed, a calamity. The paper which he delivered before the British Medical Association was, unhappily, his swan-song—the last, and the greatest of all his major contributions to the literature of surgery. It was not until 1901 that Mr. P. J. Freyer revived the interest of surgeons in the suprapubic operation, and, by his constant advocacy, and by his remarkable success, led speedily to the adoption of this method of enucleation of the prostate by surgeons all the world over.

Details of Operation.—The patient is always a middle-aged, or an old man, and is not seldom enfeebled by the long-standing distress and infection which the prostatic obstruction has entailed. I prefer, therefore, not to give a general anæs-

thetic, but to use spinal anæsthesia. From $\frac{5}{10}$ths to $\frac{7}{10}$ths of 1 c.c. of a 10 per cent. solution of stovaine is injected between the third and fourth lumbar vertebræ in the following manner. The patient is made to sit over the side of the operation table, with his back arched, the elbows resting on the knees. The skin of the back is prepared very carefully, and the area around the point to be punctured is painted with tincture of iodine. A needle, armed with a cannula, is then introduced slightly to the right of the middle line, and a little above a line joining the highest points of the iliac crests. This is above the fourth lumbar spine. As the needle is pushed deeply in, it may encounter bone ; if so, it is withdrawn, and its direction slightly altered. Its passage through the ligamentum sublavum is recognised by the fact that a rather greater resistance is offered by this structure. As soon as it is pierced, the stylet is withdrawn from the needle, and cerebral spinal fluid begins to flow. About 30 or 40 drops should be allowed to escape, and the syringe, with a long blunt-ended cannula, is then passed through the needle. The pressure of the cerebral spinal fluid is sufficient to push the piston of the glass syringe out to its fullest extent. The fluid, mixing with the stovaine, forms a milky liquid, which is now slowly injected. The bladder is then thoroughly washed out and distended with 10 or 12 ozs. of saline solution. A median incision immediately above the pubes, 2 to 3 inches in length, is made, the recti muscles are separated and the bladder exposed. A layer of fat, which should be teased away or wiped away with gauze until the bladder wall is clearly seen, covers it. Some large veins may be seen, and care is taken to push them aside, so that an avascular area on the bladder is exposed. This is incised, and the finger at once passed into the bladder. Then, on each side, a silkworm gut suture is passed through all the layers of the abdominal wall about $\frac{1}{2}$ inch from the incision, and through the bladder wall. The sutures are tied in such manner as to hold the bladder close to the under surface of the parietal wound. The sutures are left long and are held by a clip on each side. These stitches hold the bladder up to the abdominal wall, and prevent it being stripped away from the back of the pubes during the subsequent manipulations. In not one of my cases have I seen suppuration in the cavum Retzii, and I believe that

this absence of infection is due to the firm hold secured by these lateral sutures. The bladder is now explored with the left forefinger, any calculi removed, and the prostate is examined. The fingers of the right hand, which is covered by rubber glove, are introduced into the rectum, one finger is usually enough, but two may be used. By their aid the prostate is held up towards the bladder, and the stripping of the prostate with the left finger is begun. It is best, as Hurry Fenwick suggests, to pass the index finger into the internal meatus, and, by scraping through the mucosa there, to begin the enucleation of the prostate. The stripping is, as a rule, quite simple, but there is no need to hurry over it. The more cleanly it is done, the more rapid will the healing be. One lobe, generally the largest, is first stripped, below at the sides and above, then the other lobe, and finally the anterior part is separated from the triangular ligament. The urethra is divided last, generally by a special "nipping" with the finger nail; and the prostate is in the bladder. The right hand is then removed from the rectum, and a nurse removes the glove by turning the cuff down over the hand. A vulsellum forceps is then passed into the bladder and the prostate removed. It is astonishing to find now how small a cavity is left by the removal of a large prostate. A catheter is now passed, and the bladder thoroughly irrigated with 1 per cent. solution of carbolic acid. If there has been any cystitis, this lavage may well be contained for 20 or 30 minutes, until all oozing is stopped. A stitch at the top and one at the bottom of the wound are introduced, and the operation is complete. *No tube is introduced into the bladder.* The tube is not necessary, and only does harm. It is not necessary, because urine flows quite easily through the wound, where for 24 hours it is collected in pads made of gauze and cellulose wadding. If a clot should form in the bladder, the wound may be opened a little by traction upon the lateral sutures. A tube produces pressure on the wound, and makes its edges sloughy and dirty, whereas they should remain clean. It materially lengthens the time necessary for healing. In my early cases, the average date of closure of the wound was the twenty-sixth day. In my last 50 cases, there have been very few that were not healed completely in two and a half weeks. The average

day of closure is now the fourteenth day. In one case the wound did not discharge at all after the first 36 hours, and the patient left the nursing home with the wound soundly healed on the ninth day. If strict asepsis is observed, and if no tube is used, the rapidity of the healing is much increased. After the second or third day, the bladder should be washed out through a catheter every 12 or 24 hours. On the third day a Colt's apparatus is applied, with which the patient can sit up comfortably. Colt's apparatus is of the greatest possible value in these cases; it has both simplified and hastened the after treatment. The bladder should be washed out daily, a soft rubber catheter being passed, and the lavage continued until the lotion (1 per cent. carbolic acid) returns quite clear. The application of Colt's apparatus does not interfere with this procedure, it rather makes it an easier and a cleaner process, for the lotion after leaving the bladder is conducted to the side of the bed by the narrow rubber tube attached to the glass cup. The patient should be allowed to sit up in bed from the first, and should be got up out of bed as soon as possible. This was a point upon which Mr. McGill always insisted. In all cases, I order grs. 30 of acid sodium phosphate to be taken in 1 pint of water two or three times daily. It helps to keep the urine sweet and acid, but it is apt to cause diarrhœa. The dose should then be lessened. Lemonade is given freely, if the patient cares to take it. As much fluid nourishment as possible is given, and, if there is any appetite, solid food is not withheld. It is important to see that the legs are not kept too still; they may be elevated a little at night, or massaged in order to prevent stasis of the blood in them, and to avoid thrombosis of the veins.

In all cases the mass of the prostate should be removed in one piece. This involves the removal of the prostatic urethra. In the first case, in which I did this, it was quite accidental. The gland shelled out so readily that, before I was aware of it, the whole mass with the urethra was free. I was very anxious as to the outcome of this, but, when all went well, I was disposed to try the removal of the urethra with the prostate as a routine procedure. This I did, and the favourable experience, to which I drew attention in the paper, in which I advocated this measure (*Annals of Surgery*, 1904,

XXXIX., I.), has been repeated in my later cases. In several instances, I have taken away, not only the prostatic, but also a part of the membranous urethra, and never has any disability followed. But what appears to be the whole prostatic urethra is very frequently found when the specimen is carefully examined to be only the part behind the verumontanum; the anterior part of the prostatic urethra is untouched, and the ejaculatory ducts probably remain intact.

On certain occasions difficulties will be encountered in stripping the prostate. These difficulties are chiefly in connection with rather small "fibrous" prostates. The base of the bladder is hard, very stiff and unyielding, and no line of easy separation can be found. When the gland is at last removed, it will not improbably be found on microscopical examination to be malignant. In three cases I found nucleation to be quite impossible, and I therefore had to be content with digging out as much of the gland as I could get. There is another type of malignant case which I have met with on several occasions. The prostate is large, soft, easily separable, except over a small part of one lobe, which can with difficulty be stripped. The gland, when examined after removal, shows a hard, shaggy patch quite different from the smooth rounded contour elsewhere. Such a gland will show on examination a malignant change in this small area, the remainder exhibiting the usual adenomatous enlargement.

In my own cases, there have been 8 deaths, 3 deaths in 15 (probably) malignant cases; 5 deaths in 85 simple cases. Of these deaths, 2 were due to pulmonary embolism, on the 11th and 14th days respectively, suppression of urine in 2 cases, shock, death occurring within 24 hours in 2 cases both malignant, the other 2 cases died of gradual exhaustion, due in large measure no doubt to a failure in their work of kidneys long diseased.

CHOLECYSTITIS.

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A SERIES of cases of cholecystitis, which have recently come under my notice, have illustrated certain clinical aspects of the affection which are worthy of consideration, and I propose to discuss it under three headings :—

1. The different clinical types presented by the several stages and degrees of cholecystitis; 2. Their diagnosis; 3. The indications for operation.

The great majority of cases of cholecystitis are associated with the presence of gall-stones in the gall-bladder, just as a smaller proportion of cases of appendicitis are associated with the presence of concretions in the appendix. As, however, in the case of the appendix it would be wrong to describe the ordinary concretions as the cause of the attack, so in the case of the gall-bladder the biliary concretion is not the prime factor in the cholecystitis. In both cases, however, the presence of the concretion has a most important influence on the inflammatory attack, on the acuteness of the attack, and on the amount of damage that is done.

Experimental work, such as that of Miyake,[1] goes to show that the sequence of events in gall-stone cholecystitis is as follows :—1. An infection setting up a catarrhal inflammation; 2. The formation of stones; 3. A persistent chronic cholecystitis, which is liable to be interrupted by attacks of a more or less acute type.

Throughout this series of events bacterial infection is the first cause. Acute cholecystitis may occur from infection pure and simple, in the absence of gall-stones; and, on the other hand, gall-stones are associated with other lesions in the bile-channels which give rise to clinical signs and symptoms quite different from those of cholecystitis. From these considerations the question arises whether we ought not to cease to speak of gall-stone disease as such, and rather separate off the

[1] *Mitteil. a. d. Grenzgeb d. Med. u. Chir.*, 1900, Bd. VI., Hf. 4 and 5.

affections of the bile-channels according to their localisation, taking primary localisation as the basis of classification.

If this were done, one would less frequently meet with cases of cholecystitis long diagnosed because there were no attacks of typical biliary colic and no jaundice. It would then be more fully realised that the commonest bile-channel affection, with which gall-stones are associated—that is to say, cholecystitis—is quite exceptionally accompanied by either of these two signs. Every surgeon meets with cases which, for ten, fifteen, or twenty years, have suffered off and on from attacks, of more or less serious character, of an inflammatory type in the upper abdomen. Finally, drainage of the gall-bladder and removal of calculi relieve them; but this relief might well have been given years before, and would have been given, if we had not been taught in our student days that colic and jaundice were the cardinal symptoms of gall-stone disease so called. We do not speak of appendix-concretion disease; why speak of gall-stone disease? Although I am aware of a certain exaggeration in the analogy, I maintain that the point of view is the correct one pathologically, and clinically makes for increased facility of diagnosis.

Cholecystitis is clinically an affection characterised by intermittent attacks of an acute or subacute type. In the intervals between these attacks, there may be entire absence of any symptoms really troublesome to the patient; but, as a rule, and particularly after numerous attacks, the return to health is imperfect.

Clinically, therefore, we have to study two phases of the disease:—1. The attack; 2. The interval.

The acute attacks vary much in intensity, and three clinical types may be distinguished. In the first, the signs and symptoms are ultra-acute, and the condition of the gall-bladder is one of phlegmonous or gangrenous inflammation. In the second, the signs and symptoms are of moderate intensity, and tend to subside in the course of three or four days, but reappear with the onset of suppuration in the gall-bladder. In the third, the first signs and symptoms are again of moderate intensity, and gradually lessen in intensity until, after a period of from 4 to 10 days, all acute local signs and general symptoms have disappeared. The following case is an example of the

ultra-acute form. Mrs. P., aged 50, on November 1, 1907, was suddenly seized with severe pain in the right side of the upper abdomen, accompanied by retching. The pain continued moderate for 36 hours and then greatly increased, and, as she showed other signs of serious abdominal disease, I was asked by her medical attendant to see her. She had then been ill for 48 hours. The temperature was 102°, the pulse small and rather feeble, and about 120. There was slight abdominal movement on respiration, but the movement was of a shallow, jerky type, which is, I think, very characteristically associated with an acutely inflamed gall-bladder. I wish to draw attention to this point, and will say something more about it later; here let it suffice to say that the two peculiarities of the respiration are that it is markedly shallow, and usually ends with a sharp indrawing of the breath, a deep inspiration being excessively painful and more or less impossible.

To return to the patient: abdominal rigidity was localised to the upper and right segment, the right rectus being so tense that nothing could be made out beneath except excessive tenderness. Percussion, however, revealed a dull swelling projecting downwards from the liver edge. The patient was so acutely ill that we decided to operate at once, and, after separating omental adhesions, I opened a distended gall-bladder showing a gangrenous patch near the fundus. A single large cholesterin stone was removed from the cystic duct, the gangrenous portion was excised, and a tube sewn in. She did well, and the biliary fistula was closed in 12 days.

The following case is an example of the second type of acute cholecystitis. In it there was a distinct interval between the onset of the first symptoms and the onset of the more acute signs. The recrudescence was simultaneous with the development of acute empyema of the gall-bladder. Jemima B., aged 55, with a history of previous good health and no similar attack, was taken with acute abdominal pain round about the umbilicus on May 25th. She vomited several times during the evening and went to bed. The pain gradually subsided, but came on again in a very exaggerated form four days later, and she was then sent into hospital. On admission she complained of pain about the central parts of the abdomen. The abdominal respiratory movements were general, but exhibited

the characteristic of which I have already spoken. Her temperature was 103°, her pulse 100. At the inner part of the right lumbar region, a large tender tumour presented, dull on percussion, and continuous with the liver dulness. On operation, this proved to be a gall-bladder distended with pus, and surrounded by many recent adhesions. A large single stone occupied the commencement of the cystic duct. The gall-bladder was drained; the fistula closed on the 27th day.

These are two cases in which operation was required during the progress of an acute attack on account of the acuteness of the symptoms present.

The following is an example of a case in which an acute attack of moderate intensity was watched and treated by palliatives, the operation being performed after the subsidence of the symptoms. William G. had had intermittent pain in the epigastrium for seven years, usually commencing in the middle line, and then extending towards the right costal border. Three times he had been laid up for as long as a fortnight; the other attacks had not been so severe, but had recurred at intervals of about a month. On December 9th, 1907, he had a temperature of 101° in the evening, but no other symptoms or complaints. His pulse rose from an average of 70 to 96. Twenty-four hours later he complained of epigastric pain of a continuous, severe, aching character; at the end of 48 hours, the pain had definitely settled down in the right hypochondrium. At this time, his temperature, which had dropped, again rose and remained elevated for the next few days. On the third day, his respiratory movements were quite characteristic—typically jerky—and the local pain was much increased by a deep inspiration. The right rectus was held in strong contraction; no distension of the gall-bladder could be made out by percussion. The symptoms gradually lessened in severity, never reaching anything like the acuteness of the other two cases I have related. Operation was performed nine days after the commencement of the attack, during quiescence; the gall-bladder was moderately distended, the walls much thickened and adherent; a single calculus was removed, and the bladder drained. The fistula closed in 18 days. The appearance of signs of infection, in the form of elevation of temperature and increased rapidity of pulse, before the onset of local signs or symptoms, is worthy of remark. There can be

little doubt that these prodromal signs were due to an infection in the bile-channels, and, at the time of their appearance, show how infection, and not any mechanical lesion produced by calculi, is the real and original cause of the cholecystitis.

The Clinical Condition in the Interval between the Attacks.—Cholecystitis in the interval varies very much in the signs present according to the lesion left by the attack. The patient often returns to a condition of practical well-being, and all that we have left, on which to base a diagnosis, is a history of attacks pointing to pre-existent acute cholecystitis associated with only one persistent clinical sign. Fortunately these attacks are very characteristic, and in the case of a patient, who gives a history of recurrent attacks of acute pain with vomiting and fever, the pain being centred about the right upper abdomen, this history alone is almost sufficient for a diagnosis of recurrent cholecystitis. Almost the only condition which produces a similar train of events, is recurrent hydronephrosis with crises.

The one persistent clinical sign, referred to above, is tenderness of the gall-bladder. The demonstration of a tender gall-bladder is made by what is sometimes called Murphy's manœuvre. The fingers are sunk deeply under the ribs in the neighbourhood of the ninth costal cartilage, the patient is told to take a deep inspiration, and, when the tender gall-bladder comes down upon the fingers, the inspiration is suddenly checked with a kind of gasp, and pain is complained of. The following is an example of this clinical type. Sophia S., aged 35, had had occasional attacks of pain associated with vomiting for several years. Of late, the pain during the attacks had been definitely situated in the right hypochondrium. Vomiting had been a prominent symptom, she had never been jaundiced. On admission to hospital her general appearance was one of good health. Digestion apparently good. The only physical sign of disease was an enlarged and tender gall-bladder, well demonstrated by Murphy's manœuvre.

At the operation of July 31st, 1907, the gall-bladder was enlarged, with greatly thickened walls. The dilated cystic duct contained six large facetted calculi. The bladder was drained. The fistula was closed in 18 days.

Gross changes in the gall-bladder, resulting from attacks, are not incompatible with comparative good health, as in the

following instance:—

James C., aged 43, had had three attacks of abdominal pain: one, 10 years before, which had laid him up for a month; one, 12 months before, which had laid him up for a week; and the third commenced on 15th March, 1907. On the third day after its commencement he had lost his pain, which had been in the right hypochondrium, but occasionally had a twinge in his back between the tenth and eleventh right ribs. Murphy's sign was well marked, deep inspiration being arrested half-way. Temperature, sub-normal; pulse, 76. There were no other signs of disease. He was operated on nine days subsequently. There were gall-stones in the bladder and cystic duct, one being impacted in the terminal portion of the duct. The gall-bladder was shrunken, thick-walled, and sacculated. It was with some difficulty dissected out, and removed; in the course of the removal, several pockets in the liver substance were opened up and stones removed from them. A tube was placed in the stump of the cystic duct. The fistula was closed on the 18th day.

Often, however, chronic ill-health is the history of the interval between the attacks of acute symptoms. The patient suffers from constantly recurring exacerbations of infection, often associated with pain and vomiting—symptoms which are put down to "liver out of order," dyspepsia, and various other supposed disorders. The dictum which gained currency, chiefly through the influence of Naunyn, that the majority of people with gall-stones suffer no inconvenience from their presence, has been much called in question lately. Surgery has shown that the statement is, to say the least, an exaggeration. That the post-mortem room did not show this is partly due to the fact that, while recurrent cholecystitis is a most distressing malady, it is not a particularly fatal affection. That the clinical physician has accepted the dictum is largely explained by the fact that his attention has been centred on the gall-stones, rather than on the infection and the inflammatory reaction, and that gall-stones have been associated in his mind primarily with colic and jaundice.

The following case is an instance of chronic ill-health for 20 years, finally relieved by operation at the age of 60:—

Mary M., aged 60, first had an attack of abdominal pain 20 years previously; since then had had similar attacks, at

first at intervals of about a year, but, during the last few years, about every three to four months. In these attacks, the pain has, at the commencement, been referred to the left lower quadrant of the abdomen, finally settling in the epigastrium and right hypochondrium. She has never had a definite attack of jaundice. Often, in between her more acute attacks, she has been "out of sorts with her liver" for days at a time, and her daughter has thought she "looked livery." I saw her on the 18th July, 1907. She had no jaundice, no abdominal pain; her only sign of disease was a tender gall-bladder, which percussion also showed to be slightly distended. I took her in to hospital and operated on 27th July. The gall-bladder walls were much thickened, the adhesions around were few and slight. Twenty-five facetted stones were removed from the gall-bladder and cystic duct. The gall-bladder was drained, the fistula closing in 16 days. Health perfect since operation.

Another somewhat similar case, but with different interval symptoms, is the following:—

Annie W., aged 45, had had attacks of abdominal pain from time to time for 13 years. She had never been jaundiced. Between the attacks, she had been much troubled by epigastric pain coming on a few minutes after taking food, gradually subsiding without vomiting. The last attack of severe pain commenced 11 days before her admission to hospital, on 1st July, 1907. It lasted for two days and was associated with ever. On admission her pulse was 96, and her temperature 98°. In the right upper quadrant of the abdomen was a firm tumour, extending downwards an inch and a half below the umbilicus, moving with respiration, dull on percussion and continuous with the liver dulness. Only slightly tender on palpation. Operation was performed on 3rd July, 1907. The tumour was formed by a well-marked Riedel's lobe overlying a moderately distended gall-bladder. There were many firm adhesions to surrounding structures. The gall-bladder was thick-walled. On opening it a thin purulent fluid was withdrawn, not bilious in colour, and a large number of facetted stones. The gall-bladder was removed, and the stump of the cystic duct drained. The fistula closed on the 21st day. She has since been in good health.

The pericholecystitis, which was marked in this case, not

infrequently leads to very serious interference with the gastric functions. In fact, the most distressing of the interval symptoms arise from this source. The following case is in point:—

Rose A., aged 44, had been first attacked by abdominal pain 18 months before seen. This was situated in the upper part of the abdomen, towards the right side. She had had several attacks since then, none of which had been attended by jaundice. For several months she had been troubled by repeated vomiting; every day she had epigastric pain and discomfort, commencing from 3 to 4 hours after a meal and usually followed by vomiting. She became jaundiced for the first time seven weeks before admission to hospital following a severe attack of pain under the right costal edge, and this jaundice persisted for three weeks. Again, a week before admission, there was another severe attack, and the jaundice reappeared and persisted until I saw her and sent her into hospital. None of her previous attacks had been accompanied by jaundice. Her abdominal pain and the point of maximum tenderness were in the epigastrium; no tumour was to be felt. The stomach was largely dilated, reaching without distension to an inch below the umbilicus. At the operation, I had some difficulty in finding the gall-bladder, so dense were the adhesions. These were marked between the bladder and the duodenum. The careful separation of these adhesions freed the stomach, and I did not think further operation for the gastric complication necessary. The gall-bladder itself was shrunken and thick-walled, and contained numerous stones; there was also a single stone in the common duct. In this case I had to regret not having removed the gall-bladder primarily, as it had to be removed some months later for a persistent sinus. She made a good recovery, and lost her gastric symptoms, which were evidently due to duodenal obstruction by adhesions.

The following case, although not recent, I will introduce here to illustrate how a serious gastric complication may ruin the result of a cholecystitis operation:—

Sarah T., aged 66, had suffered for a long time with intermittent attacks of pain, associated with vomiting. In between the attacks, she had been much troubled by daily vomiting without any definite relation to food. She was a feeble old woman; her stomach was greatly dilated, reaching down to midway between umbilicus and pubis. At the operation

(May 2nd, 1903), the cause of this dilatation was found to be a mass of adhesions binding the pylorus to liver and gall-bladder. The gall-bladder was shrunken and thick walled, and contained numerous calculi; it was cleared and drained. After the operation, the patient suffered from continuous and uncontrollable vomiting, and died from exhaustion on the fourth day.

I think it would have been best to have combined drainage of the gall-bladder with gastro-enterostomy. The condition is a difficult one to deal with when the gastric dilatation has reached the degree which it had reached in this case. When the stomach has lost tone and the ptosis is marked, gastro-enterostomy, either preceding the treatment of the gall-bladder, or at the same time as the cholecystostomy, probably offers the best solution of the problem. In Kehr's most recent publication,[1] he records 10 cases in which a gastric operation was combined with the gall-bladder operation. In one of these, a gastro-enterostomy was performed subsequently to the removal of the gall-bladder. In four, pyloroplasty was done at the same time as the cholecystectomy, with two deaths; in five, a gastro-enterostomy was combined with the cholecystectomy, with one death. The combination of a gastric with a gall-bladder operation is, therefore, a serious undertaking. In patients much reduced by gastric insufficiency, a preliminary gastroenterostomy is probably the wisest plan to pursue.

Diagnosis.—The clinical histories which I have related have illustrated, in the first place, the clinical course of attacks of acute inflammation of the gall-bladder in its three pathological types of acute catarrhal, suppurative, and gangrenous. They have illustrated, in the second place, the conditions which may succeed recurrent attacks of acute disease. I now desire to make some few further remarks on diagnosis, first during the acute attack, and secondly during the interval.

The third case cited is of some peculiar interest as showing that, before the onset of any definite symptoms, there may be a prodromal period of fever and accelerated pulse—the first signs of an infection which produces no acute local signs until it has reached a certain height. The onset of local signs is probably contemporary with such a degree of inflammatory swelling of the cystic duct that obstruction is caused thereby. By this retention of infective material, the inflammatory reaction is

[1] *Drei Jahre Gattensteinchirurgie*, 1908.

greatly aggravated, and spreads through all the coats of the bladder, causing, in the worst cases, inflammatory gangrene.

The first symptom is acute but ill-defined abdominal pain, usually about the centre of the abdomen, sometimes even over on the left side. In the course of a few hours, however, as in the case of the pain of an appendix attack, it settles down in the neighbourhood of the inflamed organ, *i.e.*, in the epigastrium and the right hypochondrium. The temperature rises and the pulse quickens. Here, as in other abdominal acute inflammatory affections, the pulse is the most important general guide to the acuteness of the attack. Abdominal rigidity is usually localised, the right rectus is held in strong contraction, while the rest of the abdomen is comparatively relaxed. The abdominal parietes move on respiration, but the movement is shallow. As the patient breathes the tender gall-bladder moves, and, from the efforts to restrict this movement, arises the peculiar jerky type of respiration to which I have already drawn attention. At the end of inspiration there is a characteristic catch in the breath, and periodically, when respiratory needs call for a deepening of inspiration, the gasp ends in an exclamation of pain. This respiratory type is quite unlike that of extensive peritonitis where the whole abdomen is rigid, or of an appendix attack in which respiratory movements are restricted, but not associated with the acute recurring stab of pain which the movement of the inflamed gall-bladder causes. When the attack is definitely established, percussion will usually reveal a distended gall-bladder, but, during the earlier stages, this sign will not be present. The rigid right rectus usually prevents one feeling the distended gall-bladder, but palpation will show an area of exquisite tenderness underlying the upper part of the right semilunar line.

I have seen cases in which the following diagnosis of the cause of acute cholecystitis symptoms have been made:—perforation of gastric ulcer, intestinal obstruction, abdominal influenza, appendicitis. With a knowledge of the characteristic symptoms of cholecystitis, it should not be difficult to differentiate it from these affections, though I must admit an ignorance of the signs and symptoms of abdominal influenza. Examination, again, will obviate an error in those cases of pneumonia in which the symptoms are primarily abdominal.

A Dietl's crisis in intermittent hydronephosis will be

differentiated by the discovery of a tumour more definitely lumbar in position than a distended gall-bladder, and overlain by the colon. These are the most important conditions which might lead to confusion in the course of the acute attack. In cases which are met with during the quiescent period, a great deal of assistance will be derived from the history. To repeat what has already been said :—If a patient gives an account of several attacks of acute pain centred about the right hypochondrium, and associated with fever, each attack lasting from 3 to 10 days and confining him to bed, cholecystitis should at once suggest itself. The patient may seek advice for what he calls liver complaint, which is probably an attack of mild infection originating from the biliary passages ; or he may be troubled by epigastric discomfort and pain after food, or independently of food ; or his acute attacks may have left him with a more serious gastric lesion, and frequent vomiting may be his chief complaint. In all such cases the eliciting of a history of the typical recurrent acute or sub-acute attacks will lead to an examination of the gall-bladder region. I have already described the method by means of which a chronically inflamed tender gall-bladder may be made to reveal itself to palpation.

The Indications for Operation.—The indications for immediate operation in cases of acute cholecystitis are similar to those which point to urgent necessity in other types of acute intra-abdominal inflammation. The gangrenous or phlegmonous type is attended by serious signs and symptoms from the first. There are all the signs of a severe toxæmia, rapid pulse and shock, and the local signs are also pronounced. It need hardly be said that such cases require operation without delay. Perforation with general peritoneal infection is an unusual event ; if it occurs, operation gives the patient the only chance he has. Suppurative cholecystitis also calls for operative relief. Its onset is illustrated by the second of the acute cases which I have related above. A recrudescence of acute symptoms, after those of the onset of the attack have subsided, points to suppuration, and to the necessity for opening the gall-bladder. If the signs and symptoms of the attack are only of moderate severity, and gradually subside in the course of four or five days, then the best course to pursue is to wait until the patient has recovered from the distress and the toxic effects of this attack, and at the end of a

period, which in the ordinary run of cases will be about 10 to 14 days, to perform the operation which gives him final relief.

With regard to the cases which come for relief from some of the various complaints which are due to the chronic disease, if the surgeon satisfies himself that these are due to cholecystitis, he is justified in recommending operation. The operation is benign, and, in the usual case, is free from serious risk to life. One attack of cholecystitis, more surely than one attack of appendicitis, means another sooner or later. What is the alternative that can be offered to the patient? He can be told that he may find spontaneous relief for a time by the discharge of gall-stones by way of his bile channels, without, however, anything like certainty that that will or would end his troubles. The prospect is not rosy and need not further be dwelt on. The social pleasures of a Continental health resort may, of course, be offered to him; but when his next attack comes on, he will weigh these pleasures in the balance and probably find them wanting.

A question, which has been much discussed during the last two years, is whether removal of the gall-bladder should be the rule in operating on these cases of cholecystitis. There are, of course, absolute indications for cholecystectomy, such as stricture of the cystic duct; in the usual case, without such indication, my own practice is to drain a distended gall-bladder, but to remove a thick-walled shrunken sacculated bladder. The one will probably return to functional health, the other is damaged past recovery.

I have made no reference in this paper to some important complications of cholecystitis, such as acute and chronic perforation. My chief object has been to point to the necessity for further clinical study of cholecystitis as a well-defined abdominal inflammatory lesion, and more particularly for its separation from the other affections of the bile-channels with which gall-stones are associated. Further, to suggest that its proper method of study must be based on the conception of infection as the causative agent from beginning to end, and on the recognition that, although gall-stones modify, by mechanical influences, the course and persistence of the inflammatory process, yet they are not in any proper sense the cause of this process. Gall-stone disease is a term that should disappear.

THE DIAGNOSIS AND TREATMENT OF EMPYEMA OF THE MAXILLARY ANTRUM.[1]

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EMPYEMA of the antrum of Highmore, like empyemata of the other nasal cavities, has been classed as open empyema and closed empyema. In the open empyema there is a free discharge of pus or muco-pus into the nostril from the affected cavity. In the closed empyema, the flow of pus is arrested by the swelling of the mucous membrane which lines the natural ostium.

In the course of an acute rhinitis, there may be a closed empyema, and this may also occur with a chronic purulent rhinitis during an acute exacerbation. The arrest in the flow of pus gives rise to severe pain in the head and face, often neuralgic in character, and, associated with this, there may be tenderness to pressure over the cheek on the side of the affected antrum.

In the open empyema, then, with free discharge of pus, there is generally an absence of pain, while, in the closed empyema, with the cessation or diminution in the discharge, there is generally severe pain.

If one antrum only is affected, the flow of pus will be seen in the corresponding nostril. The discharge will appear in both nostrils if the disease is bilateral. Sometimes, however, there is pus in both nostrils, and yet only one antrum is involved. In this case, the discharge being profuse reaches the nasopharynx, and flows down the other nostril. By careful examination with the forehead mirror and nasal speculum, it is possible to readily eliminate the sound nostril, and trace the discharge to its source in the diseased nostril.

The discharge of pus, if long-continued, may act as an irritant and may give rise to mucous polypi and hypertrophies in the middle meatus of the nose. Occasionally, these reach

[1] Read before the Glasgow Eastern Medical Society.

a size sufficient to encroach on, or to block, the breathing channels and the patient complains that he cannot breathe through the nostril.

From these polypi and hypertrophies arise secondary symptoms, such as asthma, and they may also lead to a diminution or temporary abolition of the sense of smell; though, on the other hand, the patient is often conscious of the offensive nature of the discharge in the nostrils.

Anatomical. — The maxillary antrum is irregularly pyramidal in shape, with its base towards the nasal chambers, and its apex towards the malar bone, and sometimes projecting well into the malar bone. At birth the antrum is rudimentary, and reaches its full development in adult life. It is a cavity, variable in size in different individuals, and even in the same individual the two sides may show marked discrepancies in size and shape. If the floor of the antrum is at a higher level than the floor of the nose, we have the type of a shallow antrum. Where the floor of the antrum is at a lower level than the floor of the nose, the antrum is deep. This latter would give a well-marked alveolar recess, and, in empyema involving the antrum alone, the alveolar operation—opening the antrum and draining through the alveolus—would probably give a good result, as the drainage opening would be at the lowest part of the cavity.

In looking at the superior maxillary bone, one notices the large opening leading from the antrum to the nose; but during life this opening is closed in by the palate bone, partly by the inferior turbinal, and by the uncinate process and bulla of the ethmoid and their connecting mucous membrane. So that the natural opening, or ostium, though variable in size, is seldom large. The opening is situated at the upper part of the cavity above the level of the floor of the antrum, and hence, in empyema, the pus does not readily drain from the antrum into the nose. The ostium opens in the middle meatus of the nose, at the lower part of the hiatus semilunaris and under cover of the middle turbinal.

In a variable proportion of cases (1 to 5) there is, in addition to the natural ostium, an accessory opening from the antrum into the middle meatus. This is, as a rule, lower down and farther back in the cavity. In empyema, where

there is an accessory opening, the secretion more readily escapes through it, and the pus tends to flow backwards to the naso-pharynx. In these cases, the patient may complain of a sweetish taste in the mouth from the secretion.

This backward flow of pus may set up a pharyngitis, or, if in any quantity, by dripping into the larynx, may cause a laryngitis with hoarseness. The discharge may also be swallowed, giving rise to dyspeptic symptoms.

Not only is the antral cavity variable in size, but it may be divided into compartments by osseous or membranous septa. These chambers, commonly an anterior and a posterior, frequently inter-communicate, but, in a few cases, they are completely closed to one another. Where this occurs, the rule is that the anterior chamber opens into the middle meatus, while the posterior opens into the superior meatus.

These septa may be responsible for errors in diagnosis, and, in the operative treatment of a case of empyema, it is necessary to recognise their occasional presence, otherwise it may lead to defective drainage, and an unsatisfactory result. The mucous membrane of the antrum is covered with ciliated epithelium. It is continuous with that of the nostril, and acts as a muco-periosteum. In suppurative conditions, the mucous membrane may become greatly thickened and œdematous. Mucous polypi may arise in the antrum, and attain to a fairly large size.

The roof of the antrum is formed by the orbital plate, which has, on its under surface, a groove for the passage of the infraorbital vessels and nerves. This groove is occasionally covered in only by mucous membrane, and, in empyema, the swollen mucous membrane may press on the nerve and cause severe neuralgia. As a practical point in curetting the cavity, care should be taken to avoid injuring the nerve.

In the floor of the antrum the alveolar border is of some importance, on account of the frequency with which dental caries, with subsequent septic conditions of the roots, has been assigned as a cause of suppuration in the antrum. The roots of the teeth may form projections into the cavity, and this is especially so with the second bicuspid and the first and second molar teeth. This point in the anatomy of the antrum is worth emphasising, not only because it may be a factor in the causation of empyema, but also because it is a

guide to treatment. If a patient has an antral empyema, and we decide to operate through the alveolus, then we choose one of these teeth, more especially if it is carious. The first bicuspid, and the canine tooth, may reach as high a level as the second bicuspid, or the first or second molar (in some cases they even reach a higher level), but they tend to lie more on the anterior wall, and hence are not so sure a guide to the antral cavity. The third molar lies too far back.

Another point of practical importance is that the dentist, in extracting a tooth, may open into the antrum, and this, owing to the anatomical conditions, may happen to anyone. Should this occur, the patient is instantly conscious of the altered resonance of his own voice, and he may also, for a few days, complain of a whistling sound while speaking. The prominent clinical sign of a chronic empyema of the maxillary antrum is the presence of a purulent discharge from the nostril.

Pus in the nose or nasopharynx may come from the mucous membrane lining the nostrils, or it may be secreted in some of the accessory cavities of the nose. These accessory cavities are divided into two groups, an anterior and a posterior group.

The anterior group of accessory cavities comprises the frontal sinus, the anterior ethmoidal cells, and the maxillary antrum. The discharge from this group appears anteriorly, and it is noted, by examination with the forehead mirror and the nasal speculum, that the pus comes from underneath the fold of the middle turbinal.

In the posterior group of cavities are the posterior ethmoidal cells and the sphenoidal sinus, and the discharge from them appears in the nasopharynx.

But there are two exceptions to this general rule. First, that where there is an accessory opening in the maxillary antrum, the pus may flow backwards and appear in the nasopharynx. On examining with the forehead mirror and the nasal speculum, pus can be seen in the nostril, far back and underneath the middle turbinal, and, by posterior rhinoscopy, the discharge can be seen flowing over the upper surface of the inferior turbinal, and hence in the middle meatus.

The second exception to the rule is, that pus from the posterior group of cavities may flow forwards; but, if so, it

appears in the olfactory cleft between the middle turbinal and the nasal septum.

The pus from the anterior group of cavities flows in a common groove or gutter—the hiatus semilunaris—a groove of varying dimensions lying between the fold of the uncinate process and the bulla of the ethmoid. The highest opening in this groove is that for the frontal sinus, below that are the openings for the anterior ethmoidal cells, and below and behind is the opening for the maxillary antrum. Now, it is quite possible that pus may be secreted in one or both of the upper cavities—the frontal sinus or the anterior ethmoidal cells—and, flowing downwards and backwards in the groove of the hiatus semilunaris, may involve the maxillary antrum secondarily. In other words, the maxillary antrum may not be the secreting cavity, but may act as a reservoir for the pus secreted in the higher cavities.

Diagnosis.—The problem is, that there is a discharge of pus from the nostril, it is seen to come from underneath the middle turbinal, and presumably it comes from one or other of the anterior group of cavities, either the frontal sinus, or the anterior ethmoidal cells, or the maxillary antrum. How can the question of the differential diagnosis be settled? In other words, how can we tell that the pus comes from the maxillary antrum?

1. *Postural Test.*—Use a forehead mirror and a nasal speculum. Apply a 10 per cent. solution of cocaine with a few drops of adrenalin to the nostril. This has the double advantage of rendering the mucous membrane non-sensitive, and also of shrinking the volume of the turbinals. With mops of cotton-wool thoroughly cleanse the nostrils of all secretion. Then bend the patient's head well forwards, with a slight inclination to the opposite side from the suspected cavity. This permits the pus to more readily escape from the antrum into the nostril. Examine again, and if the nostril, which a few minutes before had been cleansed, is now filled with discharge, the probability is, that it comes from the maxillary antrum. Patients, with maxillary empyema, will often affirm that they have noticed that the discharge drips from the nostril when the head is bent forward. This is one of the presumptive signs of empyema of the antrum of

Highmore. It is not diagnostic, it is only presumptive.

2. *Transillumination of the Antrum.*—Darken the room, and, if the patient wears a dental plate, remove it. Put an electric lamp into the patient's mouth, and ask him to close the lips over it. In the normal individual with healthy antra, both sides of the face may be illumined, and especially it is noticeable that the infra-orbital region is clear. If there should be pus in the antrum, there will be a dark shadow on the cheek of the affected side, when compared with the bright translucent aspect of the face on the healthy side.

Sometimes the test does not give us any information. Both sides of the face may appear dark. This may mean that there is a bilateral empyema, but, in the presence of a unilateral nasal discharge, this would be unlikely. It more probably denotes that there is a thickness of the bone. This is one of the fallacies in the test, that both sides may appear dark because the bone is thick and does not transmit the light well. It is to be noticed that the dark shadow does not necessarily mean that there is pus in the antrum. A solid tumour in the antrum will also give a dark shadow on transillumination. On the other hand, as Logan Turner points out, if there is a cyst in the antrum, the illumination on the diseased side is intensified.

In applying this test, it may be noticed that the pupil of the eye on the healthy side is a bright red colour in contrast to the dark pupil on the affected side, and, on questioning the patient, he may be conscious of the light in the eye on the healthy side, while there is no sensation of light on the diseased side. Some observers lay considerable stress on these subjective light sensations.

Transillumination is a good test when it shows a dark shadow under the eye on the side corresponding with a unilateral discharge of pus from the nostril. It is not of the same value in bilateral affections of the antrum.

3. *Catheterization of the Antrum.*—This is, as a rule, a difficult test to perform, and in only a small proportion of cases can it be successfully accomplished. With the forehead mirror and a nasal speculum, an attempt is made to locate either the natural ostium of the antrum, or its accessory opening, if there is one. It will considerably facilitate the

examination if all polypi and hypertrophies, which may be present in the middle meatus, are first removed. The secretion is carefully mopped from the channel, and a curved cannula is passed into the ostium or the accessory opening. If this is successfully done, an inflating bag may be fitted to the end of the cannula, and the secretion blown from the antrum into the nostril, or the cavity may be washed out with an antiseptic solution. If pus appears it is diagnostic. This method can be used for treatment, and the antral cavity washed out daily, but it implies daily attendance on the surgeon for a protracted and indefinite period.

4. *Exploratory Puncture of the Antrum.*—The thinnest part of the maxillary antrum is in the middle meatus, where the wall is partly membranous. This would be an ideal spot to perforate, but it is open to the objections, first, that it is at the uppermost part of the cavity, and, secondly, that there is a risk of injuring the orbit. The point of election in exploratory puncture of the antrum is in the inferior meatus, half-way back, and well up under the inferior turbinal. In some patients, the nasal chambers are wide, and the space between them and the canine fossa is very shallow. If puncture is performed in the anterior half of the inferior meatus, the trocar may miss the antrum altogether, and appear in the canine fossa under the cheek, and may set up a cellulitis.

The antrum having been pierced and entered, the pus may be blown into the nostril with an inflating bag, or the cavity may be washed out with an antiseptic solution. The pus which escapes is nearly always most offensive in smell. This test is absolutely diagnostic.

Exploratory puncture may also be employed for the purpose of ascertaining whether the maxillary antrum is alone involved, or whether some of the other cavities are also affected. To do so, wash out the antrum and clear the nostril from all secretion. Allow the patient to wait for a short time and again examine him. If there should be renewed discharge in the nostril, it must come from one of the higher cavities, the ethmoidal cells or frontal sinus, for pus could not fill the antral cavity and discharge into the nostril in so short a time.

Sometimes exploratory puncture is made from the canine fossa, and sometimes from the alveolus, a carious tooth, if there

is one, being first extracted. I see no advantage in the latter methods. The puncture in the inferior meatus is, as a rule, easily performed, and can be done painlessly with a local anæsthetic.

Treatment.—The diagnosis being settled, the treatment consists in draining the cavity and removing the cause.

I. Acute Empyema.—In acute cases of nasal origin, such as are met with in acute rhinitis, the indication is to relieve the pain by drugs, such as phenacetin, antipyrin, Dover's powders, etc., and, locally, the use of a nasal spray of menthol and paroleine, or a weak solution of cocaine with paroleine. As there is generally a febrile temperature, the patient will be ordered rest in bed as a matter of routine. If the acute symptoms do not subside under treatment, it may be necessary to adopt some of the measures to be described for treatment of chronic empyema where the antrum is opened and drained. In acute cases of dental origin, the extraction of the tooth and drilling into the antral cavity will probably suffice. In all operations on the antrum, it is better to extract all septic teeth and roots, whether they are responsible for the antral suppuration or no.

In cases in which, after the extraction of a tooth, the cavity has been perforated, the best results will be got from treatment on conservative lines, with an antiseptic mouth wash, and an alkaline and antiseptic nasal douche. If the cavity should suppurate, the suppuration will soon limit itself, and the patient will do well.

II. Chronic Empyema.—With regard to the chronic cases, the open empyemata, where there is a free discharge of pus into the nostrils, there are many suggested lines of treatment of which the following are the most important:—

A. The Alveolar Operation.—Extract a tooth, the second bicuspid or the first or second molar, because the roots of these teeth lie nearest to the antrum, and more particularly if one of these teeth is carious, and then drill into the antral cavity. If this should have been done as a method of diagnosis, and pus be found, then at the same time the channel can be enlarged, the antrum washed out, and packed with gauze. Should it be considered necessary to keep the opening patent for some time, a metal tube can be worn. It

the patient wears a dental plate, a plug can be fitted on to this plate.

B. Operation from the Canine Fossa.—Drill into the antrum from the canine fossa. This method would be chosen if the teeth were all sound, rather than sacrifice a good tooth.

These two operations can be done under a local anæsthetic, or a general anæsthetic may be given, such as chloride or bromide of ethyl or nitrous oxide gas. They are not severe operations, and they have the further advantages that the patient need not be confined to bed for any length of time, and it may be left to the patient himself to carry out the treatment.

C. The Radical Operation.—A general anæsthetic is required. The mucous membrane is incised, the cheek is raised, and the antral cavity is entered from the canine fossa. A counteropening is made into the nose at the level of the inferior turbinal. The wound in the mouth may be stitched and the cavity packed from the nostrils.

D. Another method, which has received a considerable amount of professional support, is to drill into the antrum from the nasal chambers. The anterior extremity of the inferior turbinal is removed, and with a large oval-shaped bur the antral cavity is entered.

It may be asked, what are the relative advantages of these different methods of operating? It will perhaps simplify the problem if we regard it in the light of the ætiological aspect of empyema. Is the suppuration in the maxillary antrum dental or nasal in origin?

If it is dental in origin, arising from a septic tooth, and if the antral cavity alone is involved, the probability is that the alveolar operation will suffice. In chronic empyema of nasal origin, there is often more than one of the accessory nasal cavities involved, and chiefly the ethmoidal cells. This, I think, is much more frequent than is generally accepted. When one sees how intimately the ethmoidal cells are associated with all the other accessory cavities of the nose, the frontal sinus, the maxillary antrum, and the sphenoidal sinus, one realises that the ethmoidal labyrinth dominates the whole question of treatment of accessory sinus suppuration. If the maxillary antrum

empyema is associated with suppuration in the ethmoidal cells or fronto-ethmoidal cells, nothing short of the radical operation will succeed.

The alveolar operation, or that through the canine fossa, is not so commonly performed now, as formerly. One reason for this is that, in the radical operation, the opening in the canine fossa is made large enough to allow a survey of the interior of the antrum, to see if there are pockets requiring careful curetting, to remove, if necessary, mucous polypi from its walls, and to occasionally discover the presence of a foreign body, such as a tooth, in the cavity. The opening in the alveolar operation is too small to permit of this being done, and hence the want of success in the treatment of many of these cases. Still, in acute conditions of the antrum requiring treatment, the alveolar operation is to be recommended, with the proviso, that, if this milder operation failed, the more radical operation would require to be done. As a matter of practical experience a word of caution might be given: not to advise the alveolar operation if the patient has a high vaulted palate, or where the space between the nasal chambers and canine fossa is very thin. If the alveolar operation is attempted in cases like these, not only would there be a long distance to drill before reaching the antrum, but, unless a good line is kept, which is very difficult to secure, it would be found that the antral cavity had been missed, and the drill would appear in the floor of the nose, or in the canine fossa under the cheek.

The after-treatment is sometimes protracted, but, in my opinion, the radical operation gives the most successful results, it being understood that any of the other accessory cavities must be treated if this should be found to be necessary.

A CASE OF PUERPERAL ECLAMPSIA TREATED BY RENAL DECAPSULATION, WITH SOME REMARKS ON THE TREATMENT OF ECLAMPSIA.

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Puerperal eclampsia is a condition so dangerous to the patient, and so taxing on the resources of the practitioner, that I make no apology for bringing before the notice of the profession a method of treatment which, though advocated for some time and practised to a small extent in America, has been hitherto untried, so far as I am aware, in this country.

The patient, whose history I am about to relate, was a primipara, aged 24 years. I was sent for to see her on September 3, 1907, by Dr. Gavin Orr, who gave me the following history on my arrival. She had been in robust health up till that morning, and a sample of her urine, tested a few days before, was free from albumen. Early on the morning of the 3rd, Dr. Orr was summoned, as labour pains had begun. Shortly after his arrival, at 6.0 a.m., she had her first fit, and, as the os was fairly well dilated, the forceps were at once applied, and delivery was completed by 6.30 a.m. Two more fits occurred during the third stage, and shortly after the delivery of the placenta the fits became established, with a periodic recurrence of twenty minutes. Dr. Orr gave morphia hypodermically, the bowels were freely moved, and free action of the skin and kidneys was promoted by hot stupes to the loins and abundant clothing. I arrived about 12.0 noon and found the patient comatose and cyanotic, the skin rather dry, the pulse 120 in the intervals between the fits, the onset of which could be timed by the watch to a period of twenty minutes, and which lasted about $1\frac{1}{2}$ to 2 minutes. The patient was given $\frac{1}{3}$ grain morphia hypodermically, and the pupils, which had been widely dilated, contracted down and remained so for some hours. I at once proceeded to give five pints of saline subcutaneously. We attempted to anticipate the fits

by giving chloroform shortly before each one was due, but, although the regular paroxysm was averted in this way, the method only resulted in two fits occurring during the next twenty-minute period, so this was abandoned. As her condition was no better at 2.0 p.m. I decapsulated the right kidney: the operation lasted twenty minutes, and the patient had a fit while on the table. She had three more at irregular intervals before 4.0 p.m., when I left the house, after transfusing a further 3½ pints of saline, and giving another ⅓ grain of morphia, as the pupils were beginning to dilate. Dr. Orr stayed with her till 6.0 p.m., and before leaving transfused 4 pints more of saline. During that time she had six fits. A trained nurse came on the scene at 6.0 p.m., who transfused 4 pints at 10.0 p.m., and a further 4 pints at 6.0 a.m. the following morning, making 20 pints of saline in all in 18 hours. The patient had three fits in rapid succession between 6.0 and 7.0 p.m. on the 3rd, one about midnight, one at 3 a.m., and a slight fit about 2.0 p.m. on the 4th, making forty fits in all. During the night the skin acted very freely, and the bowels were washed out with copious enemata.

On his visit next morning, Dr. Orr found the patient still in a very bad condition—comatose, with a pulse of 120–140, and with well-marked petechiæ on cheeks, neck, and chest. I saw her again at 4.30 p.m., when there was a marked change for the better. The pulse was low, strong, and full. Her condition now closely resembled that of cerebral irritation: she lay on her side, turning away from the light, ground her teeth almost constantly, and resented any interference, such as the passage of a catheter, the dressing of the wound, or the like. The skin had a yellowish tinge, and the petechial marks alluded to stood out very prominently. I advised ⅓ grain morphia to quiet her, and, in view of the jaundice present, and the amount of chloroform which had been administered, gave sodium carbonate by the rectum, and prescribed a mixture containing sodium lactate and phosphate by the mouth. Under this treatment the patient grew better, she fully regained consciousness, the jaundice gradually cleared up, and although convalescence was delayed by an attack of cystitis, and by sloughing of the skin of the heels, recovery was complete in from three to four weeks.

The number of the fits and the duration of unconsciousness mark the case as a severe one, and I should like to briefly discuss the part in her recovery played by the various remedial agents employed.

Whatever be the exact pathology of puerperal eclampsia, I think that no reasonable man, who has studied the subject, can doubt that the main factor is a toxæmia, and that the fits are induced by the action of the toxin on the brain. Granted this as a premiss, it follows that our logical treatment is to neutralise, or to eliminate, the toxin, and that it is of secondary importance to control the fits. Unfortunately, the fits are such a striking phenomenon that this secondary object often usurps in practice the chief place in treatment, and the patient is dosed with chloroform and morphia to depress the activity of the cerebral centres, while very imperfect means, or none at all, are used to hasten the elimination of the poison which is the root of the mischief.

The administration of chloroform I regard as almost useless in the way in which it is generally given—namely, at the onset of each fit. At the beginning of the fit the patient is in a condition of apnœa, and no chloroform gets into the lungs at all. When this stage has passed, and breathing recommences, the fit is passing off and the drug is superfluous. Continuous administration of chloroform is in itself fraught with danger, and there is already a large body of evidence to show its poisonous effects on the liver. One constant post-mortem finding in eclampsia is degenerative changes in the liver. I am convinced that a part at least of this degeneration should be ascribed to the chloroform which had been used in the treatment of the fatal case; and if part is to be set down to the results of the toxæmia which caused the eclampsia, the knowledge that such changes are probably present in every case should make us still more reluctant to subject an already diseased organ to the harmful influence of chloroform. Add to this that research on the action of anæsthetics has shown that chloroform paralyses the urinary secretion, which is already sufficiently hampered in eclampsia, and I think we have established a case strong enough to make one very cautious in the use of chloroform, or even to abstain from it altogether.

The use of morphia is not so objectionable; it has, at any rate, the advantage of promoting the action of the skin, and although I have never been able to convince myself that it has the power, in safe doses, of controlling the fits, I think that, at any rate, it probably does little harm.

We now come to the measures which may be adopted with a view to eliminating the poison from the patient. Three channels of elimination are open to us—the bowels, the skin, and the kidneys.

Of these, the bowels may be acted on at once by copious enemata, and this should always be the first measure to be adopted, and should be repeated from time to time.

The value of the skin as an eliminating organ for toxins is not, so far as I know, proven; and it seems to me that a fruitful line of research is to be found here, for if, as one would reason from the normal composition of the sweat, the skin is mainly conspicuous as an eliminator of water, and only suffers organic bodies to pass in small quantity, or not at all, profuse diaphoresis, by increasing the concentration of toxins in the blood and lymph, may produce more harm than good.

The action of the kidneys in cases of eclampsia is almost always greatly lessened, or is even in abeyance altogether. Whatever reliance may be placed on the skin or on the bowels as factors in elimination of toxins, there can be no doubt that their place is entirely a subordinate and auxiliary one, and that in the re-establishment of the kidney secretion lies our surest hope of getting rid of the toxins which are the cause of the whole trouble. Post-mortem examination shows that seldom, even in fatal cases, advanced kidney disease, or anything, which would render the organ incapable of carrying out its function, is present. The most usual change is a hyperæmia and acute congestion, which may well be due, in part at least, to the press of work thrown on the organ by the presence of an excess of substances to be got rid of. We are, therefore, acting on sound therapeutic lines if we endeavour, by every means in our power, to render it possible for the kidney to carry out its office.

Chief among these means I would place the injection of saline solution. There is, of course, the theoretical objection that excess of fluid added to the blood may cause acute œdema of the lung. Those who still dread this bogey should

read Cohnheim's *Pathology*, where they will find that œdema of the lung cannot be induced by increasing the circulating fluid, but that, when it occurs, it is an agonal change, and due to the circulatory changes immediately preceding death. The effect of the injection, which is best made hypodermically and not intravenously, is to dilute the blood and lymph, and consequently the concentration of the toxins. Its secondary effect is to promote both diaphoresis, and, still more, diuresis. The amount to be given should be heroic, but should be spread out over a fairly long period, so as to maintain a constant flushing action. If the injection is given hypodermically you cannot introduce it too quickly. I find Down's transfusion apparatus with two needles easy to work, and sufficiently rapid in action, and I think the most suitable place for injection is under the breast. You will avoid the unpleasant sequela of sloughing of the breast if you make sure that your needle lies really under the gland and not in its substance.

Lastly, I come to the question of decapsulation of the kidney. And here perhaps I should detail the history of this patient's urinary secretion from the time of delivery. Before putting on forceps, Dr. Gavin Orr drew off by catheter a small quantity of urine which was strongly acid and turned solid on boiling. During the succeeding eight hours, from 6.0 a.m. to 2.0 p.m., when I catheterised before decapsulating, only 1½ oz. of urine were secreted, of the same quality as the earlier specimen. In the ensuing two hours (2.0 to 4.0 p.m.) 2 oz. were secreted, and in the next fourteen hours (from 4.0 p.m. till 6.0 a.m. the following morning) 20 oz. were secreted, containing markedly less albumen. In the 8½ hours following 32 oz. were secreted, with only a trace of albumen.

There can be no doubt that we were successful in getting the secretion of the kidneys re-established. I have a perfectly open mind as to which, if any, of our remedies deserved the credit for the happy result. The saline, which had been given on my arrival at 12.0, may have only been commencing to act at 2.0, and we may note that, after decapsulation, the patient had 15 pints more saline, so that the credit of the flushing out, which took place during the next night, may be attributed to that. As regards the operation itself, I may say

that it is so easy that I was able to complete it in twenty minutes without an assistant, and in the unsatisfactory surroundings of a farmhouse bedroom. The exposed kidney was deeply congested, was tense and full, and on separating the capsule, considerable venous hemorrhage took place, which may also have contributed to the good result. The wound gave no trouble and healed by first intention.

In conclusion, I would say that the value of decapsulation is not proven, but I would have no hesitation in recommending an operation that is so easily performed, and that certainly has many theoretical considerations in its favour, in any severe case of eclampsia which was not yielding readily to other remedies.

As regards the disputed question whether it is better to empty the uterus at once on the onset of the fits, or to wait for full dilatation of the os, I must say that my opinion inclines to the view that the sooner the uterus is emptied the better for the patient.

NOTE.—In some remarks made on this paper, Mr. Robert Campbell detailed the history of a case of chronic Bright's disease, on which he had performed decapsulation at the Children's Hospital, Belfast, and in which the operation was at once followed by a large increase in the quantity of urine secreted. Unfortunately, now, at the end of twelve months, the boy's condition is as bad as ever, due probably to the thickening and contraction of a new fibrous envelope around the kidney. This raises the question as to the after-result of decapsulation on a healthy kidney such as I was dealing with; but I think there need be no apprehensions, as untoward results have never followed the fairly wide stripping of the capsule, which is a feature in most methods of nephropexy. I had an opportunity, a few years ago, of examining microscopically a kidney which had been so fixed, and, although a capsule had been formed over the denuded area, there was no sign of fibrous ingrowth in the underlying kidney substance.

RETRODEVIATIONS OF THE UTERUS AND THEIR TREATMENT.[1]

By W. BLAIR BELL, M.D., B.S.,
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THESE malpositions of the uterus have been recognised as long as gynæcology has been a science; it is, therefore, somewhat remarkable to observe how unsettled medical opinion is at the present time as to the best lines of treatment.

The reason is not far to seek. Looking at the matter broadly, and perhaps with slight exaggeration, we can divide gynæcologists and practitioners into two classes: there are those who say, "Here is a retroversion, let us cure it," and others who say, "It is only a retroversion, let us leave it alone." Surely there can be no scientific justification for such dogmatic statements on either side. Further, with those who favour interference, I think efficient treatment has in the past been hampered by the empirical methods they have adopted:—some (for the most part general practitioners) are entirely for treatment by pessary; the rest (usually gynæcologists) by operation. But the confusion does not end here, for many gynæcologists have limited themselves to one special operation, which may be wholly unsuitable to the majority of cases. This state of affairs, then, is my excuse for bringing to your notice such an everyday complaint. Nowhere have I come across any adequate attempt to correlate the pathology and treatment, nor, in this country, to accord proper recognition to the more modern operations.

I hope you will consider the matter in the light of your own experience, for these displacements and contortions are so common that no one can be without ample experience, nor have failed to recognise the importance of them, be he in general practice, or a specialist in the diseases of women. I suggest that you recall cases seen lately in order that you may gauge whether my remarks justly apply to those cases or not.

As I have said, much of the confusion just mentioned has arisen from the fact that the pathology of these conditions has not been sufficiently taken into account in deciding upon

[1] Read before the Birkenhead Medical Society.

the treatment. *It is far too common to consider the actual deformity or displacement of the uterus, without considering the causal factors and the symptoms associated with it.* What can be better evidence of this than the identical treatment meted out to all and sundry cases that come within the experience of some practitioners and gynæcologists. For some there is nothing but the Hodge pessary, for others ventrofixation. In discussing the subject I shall therefore, in the first place, endeavour to give a concise view by dealing with it from a pathological standpoint, and at the same time attempt to point out the methods of treatment which have given the best results in my own experience in each class of case. Afterwards, I shall deal with the operative procedures which may be necessary.

A.—(1) *Congenital (or Developmental) Retroversion.*—It is extremely common to find a condition of retroversion, usually moderate in degree, in young girls, and I have very little hesitation in saying that there are no symptoms dependent upon it. Even if there are symptoms of dysmenorrhœa, I cannot honestly say that I think they are due to the position of the uterus, or that the pain is relieved by keeping the uterus forwards either by operation or with a pessary. This condition is best left alone, and the patient ought not to be informed of the state of affairs. Should she marry and become pregnant, the uterus will probably assume the normal position; if it does not, and tends to become retroflexed, an Albert Smith or Hodge pessary should be inserted until the fourth month, and any subsequent displacement, if such should exist, treated on the lines to be laid down presently.

(2) *Congenital (or Developmental) Retroflexion.*—This is quite a rare condition - much rarer than anteflexion. The deformity is a fixed one, and, although the whole uterus is mobile, the contortion cannot be reduced. In many of these cases there are no symptoms, and in such cases no treatment is required. If, however, there is severe dysmenorrhœa the best, in fact the only, method of treatment available is dilatation. This should be done very gradually. There is no need for me to go into the details, which are well known, of this simple operation. Considerable relief usually follows. An absolute cure of the contortion, however, can hardly be expected unless the patient becomes pregnant.

Fortunately no symptoms are usually complained of until the patient marries, when she may have an abortion or series of abortions due to the malposition. In these cases, if the degree of retroflexion is slight, the uterus should be carefully cleaned out *after the abortion* and packed with gauze, while that organ is still in the softened condition due to pregnancy, and the fundus kept forward with an Albert Smith pessary. (Perhaps I should say that an Albert Smith pessary is merely a modification of the Hodge.) If the retroflexion is difficult to control by these means, and the fundus of the uterus tends to sit on top of the pessary, or if the displacement recurs after the pessary has been taken out in a few months' time, one of the more radical operations to be mentioned presently should be undertaken.

B.—*Puerperal Retroversion and Retroflexion.*—Into this division a very large majority of the cases, which call for treatment, falls ; consequently it may not be out of place to consider first of all what may be done in the way of prophylaxis.

It is necessary to remember that, if a woman gets over her *first* parturition well and without any subsequent backward displacement, it is exceedingly rare for such to occur after any future pregnancy. Of course if a tendency to displacement, taken in time perhaps, is found after a first pregnancy, the same condition may follow any subsequent pregnancy. However, if the woman without assistance remains well after the birth of her first child there is little fear for the future. In view of this statement it is incumbent upon every medical practitioner to examine his patient one month after confinement, and again after a second month, when involution should be complete, for recognition of the displacement thus early leads to an easy and speedy non-operative cure.

In pregnancy while the whole uterus undergoes marked softening, the lower segment, just above the cervix, is softened earlier and more markedly than the rest of the body ; subsequent to labour, this portion retains its softness longest ; it is therefore very common to see a bending back of the fundus from the want of support afforded by this lower segment which has failed to regain its tone. This falling back, or retroflexion, of the fundus is the first stage, retroversion of the whole uterus following later. One usually finds

general subinvolution of the uterus as well. In the absence of sepsis, the deformity is limp and easily reducible.

If the deformity is quite recent, and the only symptom is slight backache—without marked subinvolution and meno- or metrorrhagia, when curetting may also be necessary—it is usually sufficient to reduce the flexion, which, as already indicated, is a simple matter, and to insert an Albert Smith pessary. This may be done at one sitting, and without an anæsthetic if there is no tenderness. If, however, there is marked tenderness, an anæsthetic should be given, the deformity remedied by the recognised method of traction on the cervix, and glycerine tampons, with a light gauze pack, placed in the vagina. After a few days' rest in bed, with local treatment by hot douches and glycerine tampons, the patient will usually tolerate the insertion of the pessary, with subsequent comfort. At the same time any enfeeblement of the patient's general system should be suitably treated. These measures should effect a cure in a few months, when the uterus will have recovered its tone sufficiently to maintain the normal position unaided.

If the deformity is of long standing, so that the uterus has become settled down in the malposition, without the likelihood of the muscle wall being able to recover and retain the fundus in the normal position, or if the measures, just mentioned, fail after a trial of six months, or if a large tender prolapsed ovary is found at the same time as the displacement is discovered, then an operation for supporting the uterus should be resorted to.

C.—*Pelvic Inflammation associated with Retroflexion and Retroversion.*—In this connection it is necessary to say that the pelvic inflammation may be subsequent to the uterine malposition or the actual cause of it—but I do not think I need waste time discussing the pathological aspects of this more than to say that the inflammatory process may arise from the uterus itself (puerperal); from the appendages, or from the large bowel (sigmoid, rectum, and appendix vermiformis)—or the treatment is the same in principle.

The symptoms may be, and generally are, chiefly those of the associated disease; but, as regards the uterus—backache, constant "dragging" pain, meno- or metrorrhagia, dysmenorrhœa, sterility, or repeated abortion may cause a train of

symptoms demanding radical treatment. Pessaries are, of course, out of the question. The uterus is fixed by adhesions, and often very tender, a state of affairs which a pessary will only aggravate. The abdomen must be opened, the adhesions broken down, diseased structures removed or appropriately dealt with, and the malposition remedied by one of the operations to be mentioned directly. It is important, however, to bear in mind that this should not be done when (or if) the inflammatory process is an acute stage, unless the exigencies of the case demand immediate laparotomy.

D.—*Retroversion as an Early Stage of Prolapse.*—Nearly every case of prolapse commences with a retroversion of the uterus, and it is most important to recognise any degree of descent which may be present. There is no doubt, I think, that a retroversion of the uterus, with slight descent, *can* be effectually treated with an Albert Smith or Hodge pessary so long as the introitus is intact, and good support is afforded to the pessary by the outlet. I have, however, a strong objection to pessaries, except as a temporary method of treatment where a cure is expected within a reasonable time; but, when the retroversion is a stage or process in the descent of the uterus, a cure is hardly to be expected, except perhaps in a few early-detected puerperal cases. If the patient will not submit to the major operation she must have the pessary; but very often the perineum must be repaired before a pessary can be effectual, in which case she will usually be willing to have an abdominal operation performed as well, and this is what should be advised.

E.—*Retroversion caused by Pelvic Tumours or Urinary Retention.*—This condition is usually sufficient to remove the cause to obtain restitution to the normal position; but if the displacement is due to a tumour and of long standing, and giving rise, as it rarely does *per se*, to symptoms, or is likely to do so, it can be remedied by one of the means to be described, at the same time as the tumour is removed.

F.—*Traumatic Retroversion.*—Retroversion without prolapse, assigned to a strain, I have seen occasionally, but it must be very rare. If the origin is really that stated, no special description of the pathology is necessary—it is obvious.

As regards treatment: if the symptoms warrant interference, one of the radical measures will be necessary, for

one could never hope to cure such a condition by temporary support. The cases I have seen were all in young unmarried women, and I must say I was strongly inclined to doubt the causal factor given.

I have not touched upon the question of retroversion or retroflexion of the gravid uterus at any length, because, after all, pregnancy is only a complication of the malposition. A discussion of it, therefore, would tend to confuse the subject I have in hand, with which it is but indirectly connected.

It will be obvious, from a consideration of the foregoing facts, that the class of retroversion and retroflexion, which gives the most symptoms intrinsically, is that which I have put under the heading of "puerperal." Fortunately, as I have said, this variety is the most amenable to simple treatment if taken in time. On the other hand, it must be clear that while those cases, in which there are adhesions, are for the most part cured by operation, the result is often due to the removal of concurrent disease; and lastly, it will have been gathered, from an analysis of the statements made, that the most unsatisfactory cases are simple retroversions in unmarried women, who are often neurotic from the unfulfilled functions of their sex, and who are not really suffering from the displacement at all. To attract the attention of these women to their already hypersensitive genital organs is a serious mistake, and one which will never bring *kudos* to the over-zealous practitioner.

Choice of Operation.—After this rapid survey, then, of the various factors determining retroversion and retroflexion of the uterus, and attempt to indicate the lines of treatment which should be adopted in each class, I must bring to your notice the various major operative procedures which have been employed. Some I shall only mention to dismiss in as many words, the more modern and better operations I shall deal with at greater length.

(1) *Vaginal fixation* (Mackenrodt), whereby the anterior vaginal wall is separated from the bladder, and the uterus is drawn down and sutured to the bladder surface of the vaginal canal. Dystocia has been such a frequent sequel to this operation that it cannot be safely recommended.

(2) *Vaginal shortening of the utero-sacral ligaments* has

enjoyed some popularity in America, but it is not a good operation for several reasons. In the first place, it is difficult to perform satisfactorily per vaginam, and, secondly, it fails to relieve any flexion which may be present. I should therefore class it with—

(3) *Alexander's operation,* in only being able to remedy a condition of simple mobile retroversion, such as is found in young women and requires no treatment at all. Alexander's operation for shortening the round ligaments in the inguinal canal is, therefore, only feasible in the uncomplicated and often symptomless cases mentioned. It may be asked if it is not a useful operation in puerperal cases, and I would state that it is not, because the round ligaments, being attenuated, are apt to stretch, acting as they do at a mechanical disadvantage in the direction of their "pull." The operation is therefore rarely successful in holding forward a bulky retroflexed uterus. That it has served a most admirable purpose, as the father of operations for these conditions, by instigating further advances in operative procedures, none can deny.

(4) *Ventrofixation.*—Although, in my opinion, this operation deserves to be dismissed in a few words, one is not justified in doing so, since many well-known gynæcologists employ it largely and often solely. I include in this term any operation by which the uterus is stitched to the anterior abdominal wall, whether by actual fixation of the uterus to the aponeurosis, or by the suspension due to the formation of peritoneal adhesions to the anterior or posterior (Kelly) surface of the uterus.

In the first place, these proceedings are unsatisfactory. If peritoneal adhesions are made, they may disappear: I have seen a uterus in the retroverted position a year after this operation—performed by an advocate of the method—and on the abdomen being opened no sign was visible of any previous interference. Even if adhesions are formed, they stretch and make bands which may lead, and often have led, to intestinal obstruction. To avoid this a complete septum from the uterus over the fundus of the bladder has been recommended (Wallace), but, even with this modification, the operation remains unsatisfactory and unscientific, since it makes an artificial condition within the abdomen which may still, should any of the stitches fail to hold (*v. supra*), lead to intestinal obstruction by the passage of a loop of intestine

underneath the septum—between it and the bladder.

Furthermore, peritoneal adhesions, stretched by the enlarging uterus in pregnancy, remain stretched afterwards, and give no support when most required during involution. Dystocia, also, has been frequently reported, and even rupture of the uterus in parturition is not unknown.

(5) *Wylie's operation* of intraperitoneal shortening of the round ligaments by folding each upon itself and stitching, with various modifications, was introduced to do away with the dangers of ventrofixation, and to overcome a disadvantage often urged against Alexander's operation, namely, that adhesions and associated disease could not be dealt with unless the abdomen was opened. In result this operation suffers from the same mechanical disadvantage as Alexander's in the direction of the pull of the round ligaments, and, although an advance in the right direction, it is now entirely superseded.

I come finally to two other methods which may be not only safely but advantageously employed when a major operation is indicated. They are methods which I have used for some years with unfailing success, but, so far as I know, they have attracted little or no attention in this country.

(6) *Gilliam's operation* is employed by most of the best operators in America, and I have myself, after an extensive trial during the last three years, become convinced of its merits. It is carried out as follows:—After the abdomen has been opened and all adhesions and disease present dealt with (which, of course, applies equally to all cases where the abdomen is opened), a stout silk ligature is passed round each round ligament about half-way between the pelvic brim and the uterus. A pair of curved ligature forceps is then passed over the recti and under the aponeurosis in young people, or directly through the aponeurosis outside the recti under the skin and fat in elderly women, and the ligature on the round ligaments seized, on each side in turn (Fig. 1), and drawn out of the abdominal incision. Traction made on the ligatures causes a loop of the round ligaments to follow through (Fig. 2). These loops are stitched on to the aponeurosis on either side close to the middle line, and the wound closed. I think it is better not to stitch the loops together, as I did at first. It causes a sense of great tightness and dragging, and in pregnancy is apt, as I saw in one of my cases, to cause some bladder

irritability. In this way the uterus is suspended close to the anterior abdominal wall by the looping and shortening of the round ligaments ; a natural position is obtained and there is no subsequent danger during pregnancy, nor does relapse occur.

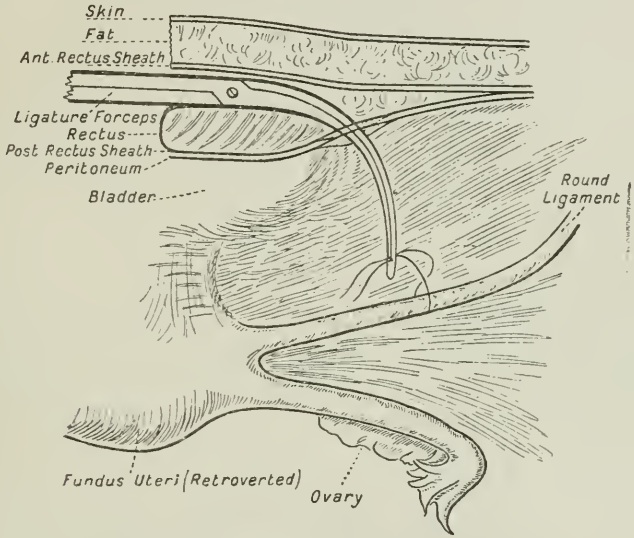

Fig. 1.—*Gilliam's operation : first stage.*

(7) *"Sling" operation*, this, the last operation I shall mention, is one independently devised by myself some years ago. It has since been described in France (Dartigues. *Revue de*

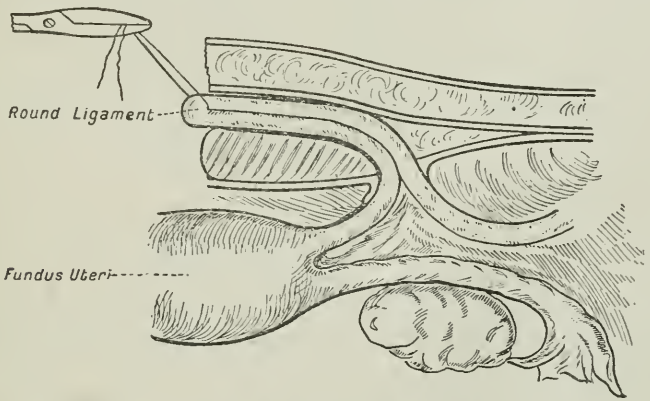

Fig. 2.—*Gilliam's operation : second stage.*

Gynécologie, Sept. and Oct., 1906), and I have recently discovered that it had been performed previously in America. Webster. *Journal Amer. Med. Assoc.*, Oct. 5, 1901.) I think

it worthy of mention because it is particularly applicable to cases in which *flexion* is marked, or when there are prolapsed ovaries to be supported. I must say, however, that I now employ it in nearly all cases *where there is no prolapse of the uterus.*

After opening the abdomen, I pass, as in Gilliam's operation, a stout silk ligature round each round ligament about two inches from its uterine attachment. A pair of ligature forceps is then thrust through the broad ligament from behind forwards on either side, passing from a little above the level of the internal os behind, to the spot where the ligature has been placed round the ligament (Fig. 3). These ligatures are then seized in the forceps, and, by means of them, loops of the round ligaments are dragged through the broad ligament (Fig. 4) and stitched to the posterior surface of the uterus near the mid-line; they should not be absolutely stitched together, but a supporting loop of catgut may temporarily

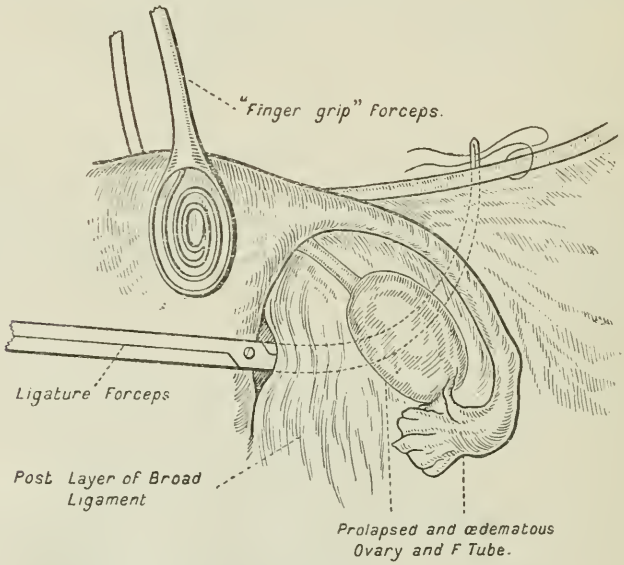

Fig. 3.—"*Sling*" *operation: first stage.*

connect them. The uterus is thus bent forward and kept up and forwards in a sling.

It might be urged against this, and in favour of Gilliam's operation, that the supposed weaker ends of the ligaments, *i.e.*, the inguinal, are left as before, and will tend to stretch. This is fallacious, for it is not what happens; it is the whole

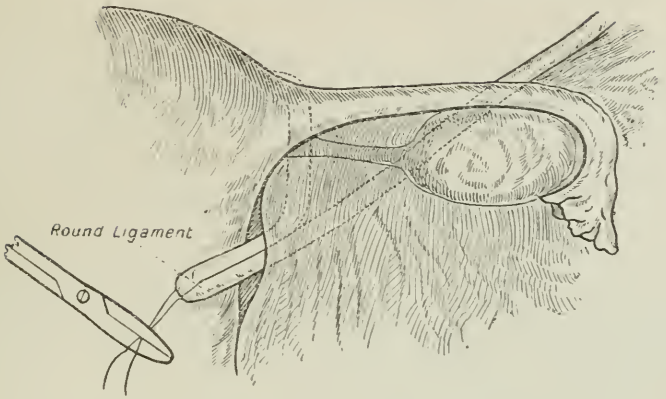

Fig. 4.—"*Sling*" *operation: second stage.*

ligament which stretches, and not the inguinal end. This will be obvious to any who has observed the attenuated flattened band which represents the round ligament during pregnancy. In both Gilliam's and the last operation the direction of the "pull" of the round ligaments is altered into a more antero-posterior plane—a great mechanical advantage. The last operation described has, as already mentioned, the additional advantage of supporting the ovaries if they are prolapsed. Generally speaking, Gilliam's operation is the best operation where there is any degree of prolapse. It is scientific, and has no clinical disadvantages, while the "sling operation," as I call it, is almost physiologically ideal, and the best in all cases of retrodeviation without prolapse when a major operation is required. With these two operations there is no excuse or justification for ventrofixation which has been, and still is, almost the only major operation practised in this country for these malpositions.

In conclusion, let me remind you that we must first decide if any operation at all is necessary. Then if a minor one will not be sufficient; but if not, let me urge upon you the necessity of employing an operation suited to the actual case, and one which, besides bringing about the effect desired, gives security against any of those evil results which have not been unknown in the past.

CASE OF GENERAL PNEUMOCOCCAL PERITONITIS ASSOCIATED WITH ACUTE PNEUMONIA.

By THOMAS KAY, M.B., C.M., F.F.P.S.,
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In the *Scottish Medical and Surgical Journal* of February, 1903, a very interesting article appeared by Dr. J. S. Fowler, in which he gives a full and clear description of the symptoms and pathology of pneumococcal peritonitis. He points out that this disease was first described by Netter, in 1890; that Méchaut (*Thèse de Paris*), in 1901, collected reports of 26 cases, and added eight of his own; also that Professor Stoss, of Bern, in October, 1901, gave a very full account of the disease, based upon four cases of his own.

Dr. Fowler describes pneumococcal peritonitis as occurring in two forms:—

1. An encapsuled purulent effusion in the peritoneal cavity.

2. Diffuse suppurative peritonitis.

The former is by far the most common, 22 of Méchaut's cases and three of Stoss's taking this form. In the encapsuled form the prognosis is good; in generalised peritonitis it is less favourable, there being, apparently, only three recoveries recorded.

The following case is one of general peritonitis. Very few such cases have been recorded, and the diagnosis, at least, of the disease is not common, though it is probable that, if a systematic examination of the pus, taken from the abdomen, were made, it would be found that the pneumococcus was much more frequently the cause of acute peritonitis than is supposed.

The patient, a girl of six, was admitted to the Royal Infirmary about one month after the beginning of her symptoms. Up to the time of her illness she had been a perfectly healthy child. The following short history of her symptoms, previous to her admission into hospital, was obtained from her medical attendant. She went to bed apparently quite well, but awoke about one a.m. complaining

of abdominal pain and vomiting; she continued vomiting at intervals during the night. Early the following morning she was seen by her physician, who diagnosed acute peritonitis, with special tenderness in the region of the appendix. Fomentations were applied, and a soap-and-water enema given with a good result. The following day the patient remained in much the same condition, complained of pain, and continued to vomit at intervals. The next day, the third of the patient's illness, cough, for the first time, made its appearance, and, an examination of the chest being made, an acute pneumonia of the right lung was diagnosed, the whole of the lower lobe was consolidated. This ran a normal course, with the crisis about the fifth day. A few days after the beginning of the illness the motions became loose, and at the end of a week she had severe diarrhœa, about 10 motions daily; this continued till her admission into hospital. (Diarrhœa in those cases seems the rule, while the opposite is the case in appendicitis.) The chief complaint of the patient was abdominal pain, most marked in the region of the umbilicus, with tenderness on palpitation all over the abdomen, especially in the lower segment. The abdomen became much swollen, but the date when this was first noticed is uncertain. Percussion showing free fluid in the peritoneal cavity, the medical attendant introduced a trocar, and, finding pus, had the patient removed the same day to the infirmary.

She was admitted to the Royal Infirmary late one afternoon. On admission the temperature was 101·8, pulse 126, and respiration 36. When seen the following morning, she lay on her back with knees drawn up, moaning and complaining of pain in the abdomen, which was markedly swollen, with distension of the superficial veins, and gave a dull note on percussion all over. There was tenderness on the slightest palpation. Emaciation was very marked. It having been decided to operate at once, the abdomen was opened in the middle line below the umbilicus, and about 90 ounces of pus evacuated—80 ounces were measured and fully 10 ounces lost. The pus was about the consistency of thick cream, had a pale greenish colour, and was free from odour; a sample was kept for bacteriological examination. The abdominal cavity

was washed out with 1 per cent. saline solution till the fluid came back clear, and two drainage tubes were introduced, one into the abdominal cavity, the other into the pelvis. It was intended to make openings behind to get better drainage, but the child was so weak that it was decided to get her back to bed as quickly as possible. The temperature, which was 102 before operation, dropped almost at once to 99, and while she was in hospital only twice rose over 100, once on the fourth day and again on the fifteenth. After the operation the patient had no more pain, and steadily improved. The abdominal cavity was washed out daily with saline solution for the first week, and then at less frequent intervals; the drainage tubes were gradually shortened, and were finally dispensed with on the twenty-first day. The patient left the hospital at the end of six weeks perfectly well. She was seen about 18 months afterwards, and was then well, and had been in good health ever since her dismissal.

A bacteriological examination of the pus gave Fraenkel's pneumococcus in pure culture.

It was only after this examination was made that the fact that she had previously had an attack of pneumonia was elicited.

Pneumococcal peritonitis occurs quite independently of any lung affection; in fact, such is usually the case. According to Dr. Fowler, the peritoneum may get infected either through the blood-stream or from a neighbouring organ; he also says that the pneumococcus has been frequently isolated from the intestinal contents, and that it is probable that the intestines are the most common cause of the peritoneal infection. There may also be a direct infection of the peritoneum from the pleura through the diaphragm.

In the case which I have just recorded, the right lung and the peritoneum were both affected, and the question naturally arises, what connection the one had with the other? The abdominal symptoms were certainly the first observed, and were treated for several days before the appearance of any pulmonary symptoms; so, in all probability, the infection came from the intestines to the peritoneum, and, afterwards, the lung became affected through the blood-stream.

X-RAYS IN THE TREATMENT OF CUTANEOUS TUBERCULOSIS.[1]

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THE clinical forms of cutaneous tuberculosis, in which I have employed X-ray therapy, have been, so far, the non-ulcerative and ulcerative forms of lupus vulgaris and tuberculosis verrucosa.

In the main, my remarks will be upon the treatment of lupus vulgaris to which for some time I have been devoting considerable attention. It is not my intention to deal with lupus erythematosus—as to the ætiology of which there is much division of opinion—but to confine myself to lupus of generally admitted tuberculous nature.

It is from the standpoint of the dermatologist that I would direct your attention to the question of therapeutics, and in so doing would claim neither the X-rays nor the Finsen light as the only method at our disposal for the treatment of lupus vulgaris. With your permission I will briefly refer to one or two of the older methods employed in the treatment of this form of cutaneous tuberculosis. One of these stands out with conspicuous prominence, and justifiably so, on account of the excellent results obtained by its exhibition in extensive facial lesions of an ulcerative and hypertrophic character. I refer to that of multiple linear scarification, especially associated with the French School of Dermatology, much practised and recommended by such authorities as Brocq and Hallopeau, the latter of whom strongly advocates, in addition to the scarification, the application of a 5 per cent. aqueous solution of permanganate of potash. In this country an objection to this treatment is the necessity for repeated general anæsthesia which, although quite well induced by nitrous oxide, might not commend itself to every patient. In Paris, it is no unusual thing to see patients in the skin cliniques submit to this treatment with a surprising and enviable stoicism, without the employment of any anæsthetic, local or general.

[1] Portion of an address delivered before the Clinical and Pathological Society, Paisley.

As the most common site of lupus vulgaris is the face—often the nasal region—surgical interference is contra-indicated, save in lesions of extremely limited dimensions. This restriction does not, of course, apply in the same degree to lesions on covered parts.

Scraping in lupus vulgaris of non-ulcerative type is strongly recommended by Brocq and justifiably condemned in ulcerative lupus, where it may be followed by most unsightly cicatrices and conspicuous disfigurement.

With respect to the galvano-cautery. It may be said that, while of considerable value in isolated lesions, such as those appearing in an old cicatrix or persisting from inefficient curetting, it should be used with great caution in the vicinity of orifices where vicious cicatrices may be thereby very easily induced. It is not recommended in such cases. In fact, for the reason just stated, it is distinctly contra-indicated. It is, however, of considerable value, and is much employed in lupus of the palate, pharynx, and mucous membranes generally.

In concluding this cursory review of the relative merits of some of the various methods of treatment other than actinotherapy and X-ray therapy, I would recall to your memory that method associated with the name of Holländer of Berlin, in which a stream of air, heated to some hundreds of degrees Centigrade, is directed upon the lesion with the production of an eschar, which is subsequently removed by scraping. At the conclusion of a visit to Berlin, I had the pleasure of manipulating Holländer's apparatus under his supervision, but was unable, personally, to follow up the case treated. Holländer claims, however, most excellent and rapid results from his treatment when properly carried out.

At the Paris Congress on Tuberculosis—of which I was a member—much time was occupied with communications dealing with the value of the newer methods, phototherapy and X-ray therapy, compared with that of the classic ones of multiple scarification, physical and chemical cauterisation, etc., employed in the treatment of lupus.

While the older methods had strong support from more than one authority of eminence, the consensus of opinion of those who had had practical experience of the newer methods was that the Finsen method gave the best results. The adverse opinion

of that method was largely determined by its costliness and the prolonged treatment involved. Opinions with respect to the X-rays were, in the main, only in favour of their exhibition as an adjuvant to phototherapy.

In reviewing the results of 633 cases treated at the great Paris Hospital of Saint-Louis, my friend and master Professor Gaucher said : "Phototherapy gives very good results in the two varieties of lupus. It has the merit of giving in general beautiful cicatrices, but it is a long and costly process, not within the reach of everybody, and is not applicable to every region, in particular to cavities and mucous membranes. The Finsen method remains at present the best. Radiotherapy has an analogous action to but more intense than phototherapy upon tuberculous lupus. It is more difficult to control."

While everyone must admit the high value of the Finsen method, of which the resulting cicatrix is unsurpassed from the æsthetic point of view—in fact, from every point of view—yet anyone, at all experienced in phototherapy, will have found that the great length of time involved in the treatment of extensive lesions is a great drawback to its value. In fact, in hospital practice a large number of cases are of such dimensions that phototherapy would be an almost interminable process, and in many instances an almost impracticable one from the social position of the patient, who, unless accommodated in hospital, would be unable to attend until a cure was effected.

About two years ago I began to use the X-rays more frequently for the treatment of lupus vulgaris with the object of diminishing the length of treatment, and found it was possible to obtain, in ulcerated and hypertrophic cases, a relatively rapid response culminating in a smooth and flexible cicatrix, free from the disfiguring keloidal developments not infrequently following treatment by some of the older methods.

Keeping in view two objects, relative shortness of treatment and æsthetic effects, I have been employing for facial lesions a *combined method of treatment*, which so far has given very encouraging results. In brief, the method is as follows :—If any crusts exist they are removed by the application of a salicylated ointment. A tentative X-ray exposure of from three to five minutes is made upon a small area of the lesion. In a few days the X-rays are directed for about five minutes daily upon

a somewhat wider area of the lesion, unless contra-indicated, until the whole lesion has been exposed some three or four times. It is then plastered with Unna's 50 per cent. salicylic acid and creosote plastermulle, which is renewed daily. If its application is badly borne, the part is previously swabbed with 10 to 20 per cent. solution of cocaine. In a variable number of days—approximately about 10 and determined by the individual case—it is found that much of the tuberculous tissue has come away. The lesion is then swabbed with cocaine solution, then dried, and afterwards painted with the following preparation :—

℞. Acid Carbolici - - - 50 per cent.
Acid Lactici - - - 15 „ „
Acid Salicylici - - - 15 „ „
Alcohol Absolut. - - - 20 „ „

(well agitated before application as there is a considerable sediment). A few minutes afterwards the lesion is painted with the following solution :—

℞. Acid Carbolici - - - 80 per cent.
Alcohol Absolut. - - - 20 „ „

(The formula employed in Billet's phenol method.)

In very extensive cases a part only of the lesion is cauterised, the remainder being cauterised on one or more subsequent occasions. However, a whole cheek may be done at one time. More than once I have cauterised both cheeks and nose at one and the same time. I do not, however, recommend such extensive cauterisation on account of the associated œdema, which it is well to avoid. After cauterisation the part is dressed for a day or two with sterilised lint and carbolic oil (1 in 30), and, thereafter, with 20 per cent. aqueous solution of ichthyol, until healing—usually relatively rapid—has taken place ; or in some instances the application of the ichthyol solution is deferred until the lesion has been replastered and recauterised—perhaps three or four times. After healing in the manner just described, which may be accelerated by bathing the part at the time of dressing with a little of the ichthyol solution, to which 25 to 50 per cent. of methylated spirit has been added (cocaine swabbing is indicated), X-ray treatment is recommenced, short exposures of three to five minutes—rarely longer—being made. At

the end of three or four months, the treatment is discontinued for a considerable time, during which the patient returns periodically for inspection. At the end of this interval in the treatment—some months in duration—the patient is submitted to a second course of treatment, which is repeated after another interval, if necessary.

It should be mentioned that the patient, during the interval just referred to, is sometimes instructed to use a mercurial ointment or lotion : also that it is usual prior to the dressing of the lesion to clean it up with a solution of perchloride of mercury (1 in 500).

Whenever indicated, local treatment is supplemented by the exhibition of hæmatinics, Ol. Morrhuæ, and saline aperients, and a generous diet and residence amidst hygienic surroundings are enjoined.

With reference to the X-ray apparatus, a 10-inch coil is used. The diseased area is exposed at a distance of about $7\frac{1}{2}$ inches from the anticathode of a medium to soft tube, while the parts not under treatment are protected by a lead glass diaphragm to which funnels of the same material and of various sizes, allowing exit to the rays, are attached.

This method is slightly varied in some cases, the most important modification being the submitting of the lesion to the X-rays during the period of plastering and cauterisation, with, I think, better results. Obviously this modification calls for the exercise of great caution.

What are the disadvantages—if any—in the employing of the X-rays in this method ? Too long and careless exposure may induce a radiodermatitis, which, if severe, will not only occasion the patient considerable pain, but prove extremely difficult to heal. It will be noted, however, that the individual X-ray exposures are short—no attempt is made to produce a radiodermatitis—and the periods, during which they are exhibited, are not over-prolonged. It is, I venture to think, by small dosage and lengthy intervals of rest, and so attempting to prevent the onset of cutaneous X-ray intolerance, that the best therapeutic action of the X-rays in lupus vulgaris will be obtained.

In a discussion at the annual meeting of the British Medical Association held at Exeter last August—in which I had the

pleasure of taking part—the question of epitheliomatous degeneration in lupus scars, which had been treated with the X-rays, received some attention. While not prepared to say it may not occur, I have not had, as yet, any case to record. And in reference to this it should be borne in mind that epitheliomatous degeneration in lupus scar tissue, following other methods of treatment, is a generally recognised complication.

What may be said in recommendation of this method? The aim in treating facial lesions is obviously the production of a cicatrix approximating in character to the normal skin, in other words one which is smooth and flexible and with no marked tendency to contract. The caustic element in this treatment is by no means drastic and is little calculated to produce vicious cicatrices. Indeed, in cases in which cicatricial hypertrophy existed—primary or the result of previous treatment—marked diminution in the scar tissue was recorded, doubtless due in a large degree to the influence of the X-rays, the tendency of which to reduce keloidal tissue I have also observed in dermatitis papillaris capillitii, the acne cheloïdienne of French authors.

The cicatrices resulting from this combined method of treatment are smooth and flexible—a recommendation not to be ignored, when deciding upon the treatment to adopt in lupus affecting the various orifices—very occasionally I have observed in them trifling telangiectases, and in one or two cases I have noted a few pigmented spots.

Lupus secondary to tuberculous adenitis has responded well to this treatment, largely due, no doubt, to the beneficial effects of the X-rays upon the underlying primary affection. Its greatest recommendation, however, is the relative rapidity of improvement in extensive lesions of an ulcerative or papillomatous type, where usually, after three months' treatment, a patient is enabled to return in comfort to his occupation for a quite considerable time before the commencement of a second course of treatment.

Many cases of markedly rebellious character and of many years' duration have yielded so well that one might hope—without being too sanguine—that in some of them, at least, complete cessation of the tuberculous process might ultimately be recorded.

CASE OF HENOCH'S PURPURA ASSOCIATED WITH ANGIONEUROTIC ŒDEMA.

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THE following case is of interest in that it presents many features, which are common to that indefinite class of symptoms grouped around purpura and localised œdema.

S. S., a boy, aged 11 years, complained of pains in his legs and thighs. He was fevered, sick, and vomiting, with much abdominal pain. A rash had appeared down the sides of both legs, and in the right popliteal space, a week before the vomiting commenced. When I saw him first, more than a week after the rash appeared, the most pressing symptom of his illness was abdominal pain, mostly on the right side, along the ascending colon and in the epigastrium. Pressure over the appendix caused him to wince, and fix his abdominal muscles on that side. His temperature was then 101·4°, and pulse 104 per minute, and he was vomiting at intervals, especially when he took anything to drink. The face was slightly swollen, mostly under the eyes, but not irregularly so, and the legs showed a purpuric rash, the spots being about the size of fleabites, but some covered double that area. There were two œdematous circumscribed swellings of normal colour, one $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inches, and the other 2 inches in diameter, lying along the right side of the spine over the erector spinæ muscle in the lumbar and lower thoracic regions. These did not pit on pressure, but were slightly tender to touch, and sufficiently painful to attract the patient's attention. The urine was scanty, pale, and free from albumin, and the bowels had not opened for a week.

I gave him three grains of calomel, and a bismuth mixture to be taken after the calomel had acted. The bowels were freely opened with a dark-coloured offensive motion, and the next day the pain was less in the appendix region, and the "lumps," as his mother called them, had almost disappeared from the back. Another more painful swelling had appeared on the front of the left wrist over the pronator quadratus. This was not unlike a sprain of the wrist, but was above the joint, which was freely and painlessly movable, and the swelling involved only the front of the arm for about 3 inches. There was no cardiac symptom, nor palpable enlargement of the spleen. The vomiting had entirely ceased. The face still seemed swollen, and the temperature had fallen to 100°.

He was now allowed milk warmed, and, as the pains were now severe in the arms and legs, he was put on Sod. Salicyl., gr. 5, every four hours. Œdematous patches continued to appear on the thighs and legs, back of hand and dorsum of foot, and disappeared in from one to three days. Those on the hand and foot were reddened, softer, and pitted on firm pressure. A

pupuric patch came out on the right arm above the elbow joint behind, at the end of a second week. It measured 1½ inches by 1 inch, and was irregular in outline. The urine by this time was more abundant, probably owing to the milk he was consuming. The purpuric rash on the legs was now down the front and sides, and new spots continued to appear during the second and third week of the illness. The temperature gradually fell to normal by the fifteenth day, and he soon began to recover his appetite and strength, and was quite well by the end of the fifth week.

The blood was not examined during the acute period of his illness, but, except that he was anæmic, the later examinations were negative.

The boy's own history is negative. He has always been healthy.

He has two brothers and one sister, all healthy. The mother is healthy—thin and wiry. The father, a chauffeur, is rheumaticky. An uncle on the father's side had two children both of whom died of hæmorrhage. The account I got from the patient's mother is probably exaggerated, and is as follows:—

The son died at age 41. Hæmorrhage began from the nose, but later the blood came from other orifices, and he died after a three weeks' illness, blood oozing from gums, eyes, ears, and nails. The other child, a female, had bleeding attacks at 3, 7, and 12½ years. She had a rash with this last attack, the spots being smaller than those of my patient, and there was severe hæmatemesis. She died of metrorrhagia at 15 years—her first menstrual period.

The chief points of interest in this case are the combination of the purpura, with the angioneurotic œdema. Gastro-intestinal crises are common with both Henoch's purpura and angioneurotic œdema, but the latter symptom is not common in children. Butler, in his *Diagnostics of Internal Medicine*, gives the age for angioneurotic œdema as 20 to 30 years, and says the swellings are painless, but he also mentions that Henoch's purpura and angioneurotic œdema may co-exist.

Osler, in his *Textbook of Medicine*, seems to have some difficulty in separating the symptoms of the two conditions, while Hare, in his *Practical Diagnosis*, would apply the term Henoch's purpura to the severest form of purpura only, while he would ally angioneurotic œdema more with urticaria, though he notes the absence of itching in the former affection. Colcott Fox, Quincke, and Walker put urticaria as an angioneurosis, while Pepper, in his *Theory and Practice of Medicine*, calls angioneurotic œdema, "giant urticaria," with symptoms of heat, swelling, itching—the swellings also pitting on pressure.

Recent literature does not seem to throw much light on the ætiology of either of these troubles, though on the whole

most writers agree that both are probably symptoms of some general infection. Rheumatism, purpura, and urticaria are suggested as allied conditions by Cheadle, Fox, Goodall, and others. Budin has noted œdema of an irregular and localised type following severe puerperal sepsis. Surgeons have incised these swellings in the belief that abscess-formation had taken place. I have myself opened a periosteal swelling, and drilled the shaft of the femur, under the impression that I was dealing with an acute osteomyelitis. My patient, a boy, 12 years of age, was suffering from some general condition taken to be rheumatism, and treated as such for over a fortnight, before the thigh swelling developed, when he came under my care. He had a leucocytosis of 13,500, and a temperature at times reaching 104°. No pus was found, though the shaft of the femur remained painful to pressure for over a week after drilling.

Harrington quotes a case of angioneurotic œdema where the abdomen was opened under the impression that he was dealing with gall-stone colic. The actual condition found in the bowel was interesting, as it showed general œdema of the wall of the ileum close to the ileo-cæcal valve, and extending upwards for 3 inches. The rest of the intestine had the appearance of a commencing peritonitis.

It has been noted that, in most cases where death has resulted, the large bowel has been chiefly affected, surface lesions and submucous hæmorrhages being noted, post-mortem, in the majority of cases examined. Urticaria, again, is usually associated with bowel symptoms and occasional hæmorrhages, and is attributed to some toxin in the diet, while pains in the joints are common to almost all acute septic conditions, as tonsillitis, erysipelas, carbuncle, etc.

When one tries to separate the several forms of purpura, one finds that the only difference is in the severity of the accompanying symptoms. In my own patient, all the symptoms were comparatively mild, and the boy was never in any apparent danger, yet, with this exception of renal and mucous hæmorrhages, he had all the symptoms of both Henoch's purpura and angioneurotic œdema.

It has also been noted by recent writers that a constipated condition of the bowels, followed by a diarrhœa with griping

and offensive motions, is the rule in both purpura and localised œdema.

Carriere has described a bacillus very like that of anthrax, which he found in the blood of a case of simple purpura. This bacillus had also been described by Achalme and Thiroloix as occurring in acute rheumatism. Rubovitz, Cureton, Haushalter, Etienne, Apert, and others have found pyogenic and other cocci in the blood of patients suffering from purpura and localised erythema, and the tonsils are considered a common port of entrance. Watson Cheyne found some of the capillaries in the neighbourhood of the hæmorrhages plugged with bacilli, and colonies of the same in the effused blood.

Purpura in connection with wasting diseases, such as tuberculosis, cancer, and chronic blood and intestinal diseases, has been noted by Voelcker, Raffin, Adone, Walker, and others.

Halstead, when discussing angioneurotic œdema, mentions the probability of toxins being responsible for the attacks on some persons, but he is inclined to attribute more importance to heredity. In his cases the œdema affected mostly the throat, and might have been caused by some local infection, though he suggests a vasomotor neurosis. Cases affecting the head are in the eyelids, nose, lips, or the mucous membrane of the mouth or throat, all points commonly attacked by microbial infection. I have a patient at present who is periodically affected by a pale œdema of the nose and eyelids, lasting for a week, whose husband developed erysipelas after a slight abrasion of the scalp.

There is, however, as I have said, among recent writers a tendency to look upon both diseases as symptoms of a general toxæmia, and to hold that more than one toxin is capable of bringing on one or more of the accompanying symptoms. Purpura has been noted after the injection of antitoxin for diphtheria, and after the exhibition of iodides, while swelling of the tongue and glottis is not uncommon in excessive doses of, or idiosyncrasy to this drug. Mercury, arsenic, iodoform, have also given rise to purpura after prolonged use.

Cirrhosis of the liver and Bright's disease often follow purpuric rashes and localised œdemata, and an acute hepatitis and exfoliative nephritis are usually produced by the circulation in, and elimination from, the blood of toxins, or some irritating

drug that has recently been given. Renal hæmorrhages in the young are, perhaps, most common after scarlet fever, and a purpuric rash in the course of convalescence from this disease, as also from measles, diphtheria, variola, tonsillitis, etc., has been recorded.

My own case can best be explained by assuming some lesion, probably of the ascending colon, and of some weeks' duration, which would account for the anæmia, the intestinal pain, and the vomiting. Absorption of some toxin elaborated in the bowel would account for the joint pains, and possibly, if organisms were in the circulation, for the localised œdemata and the purpura. It is quite conceivable that this œdema may be due to the stagnation in the capillaries of organisms, non-pyogenic, but which may not be so irritative to the tissues as to cause an inflammation, though sufficient to produce rupture of the capillary walls and a purpuric exudation, and the prompt removal of these organisms by phagocytes, or the escape through the damaged capillary walls of serums containing protective anti-toxins, might account for the rapid appearance and disappearance of the swellings. Perrin thinks that the toxins in the blood may so alter the walls of the vessels as to produce a blood stasis, with or without rupture, but if this were the only factor, one would then expect the condition to be more generalised. It is much more likely that the toxins act as general poisons, while the stasis is due to bacterial infection of the walls with thrombosis and rupture, which would be more likely to occur in the slower circulation in the extremities, and this explanation is quite compatible with drug eruptions, where the continued exhibition of the drug would so lower the vitality of the tissues as to allow of localised infections by the toxin-producing or other microbes.

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REVIEW OF CLINICAL PATHOLOGY.

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In no branch of the medical sciences has the importance of laboratory methods been so great, or its influence on practice so marked, as in the diagnosis of tubercle; the discovery of the tubercle bacillus, apart from its theoretical interest, being of the utmost value to the practitioner, as supplying, for the first time, a method by which tuberculosis could be positively diagnosed. For example, the recognition of advanced phthisis is usually easy, but even here there is a certain number of cases, in which clinical observation alone may be at fault, and in which the symptoms and signs of pulmonary tuberculosis may be exactly mimicked by other infections. Two such cases of streptothricial (actinomycotic) disease have recently fallen under my notice.

For the recognition of the tubercle bacillus in the *sputum*, the ordinary method is, as a rule, all that is necessary, and, as it is very quickly and easily performed, still remains in general use. But in very early cases of phthisis, and it is in these that a positive finding is of such value, the bacilli are often very scanty, and, if no other method is adopted, the search must be very prolonged. In order to avoid this lengthy examination, numerous methods have been proposed. Of these the majority aim at concentrating the number of bacilli in the sputum, whilst others are cultivation methods, having for their object the production of a pure culture of the bacillus.

Before these methods are described in full, it must be pointed out that much information can frequently be obtained, in these early cases, by a study of the cells which the sputum contains. The presence of lymphocytes, either unmixed with polynuclears, or at least greatly predominating over them, is strong evidence in favour of tubercle, in fact it is almost conclusive. It is usually held that it is the

presence of a secondary infection with one of the pyogenic coca that determines the influx of polynuclears, but I am doubtful whether this is the case. Thus in a specimen of sputum, which I recently examined, the cells were all lymphocytes, but there were numerous pneumococci present and no tubercle bacilli. The diagnosis of tuberculosis was made, partly from the cytology of the sputum, and partly from the opsonic index, and on a second examination the sputum was found to contain lymphocytes, pneumococci as before, and one or two tubercle bacilli were found after a long search. I have seen similar examples of lymphocytic sputum containing bacteria other than tubercle bacilli, and it appears to me that the presence of polynuclears indicates ulceration or cavity-formation rather than a mere secondary infection with pyogenic bacteria.

Reference should also be made to Blume's [1] method for the examination of patients who cough, but from whom no sputum can be obtained. He gives them a clean piece of glass, with instructions to cough against it for several mornings in succession. This is then stained for tubercle bacilli, and examined in the ordinary way. It would seem that special precautions ought to be taken, especially in hospitals and sanatoria, against accidental contaminations by air-borne acid-fast bacilli; this being done, the method might be one of some value.

Passing on to the methods for concentrating the bacilli, we find that they are very numerous, and depend mainly on the homogenisation of the sputum by means of dilute alkalies or of enzymes, an exception being the old and well-tried process of Van Ketel, which consists of shaking the sputum with carbolic acid solution (1–20), and subsequently sedimentation or centrifugalisation.

Of the processes, depending on the use of an alkali, we may mention the following :—

The Muhlhäuser-Czaplewski [2] method consists in the use of ·2 per cent. NaOH, which is added in amount sufficient to produce (on shaking) an even, thin liquid, all the mucin being dissolved. As a rule, a certain amount of sputum requires 4–12 times its volume of alkali. The mixture is then put into a porcelain dish and brought to the boil, being meanwhile kept

constantly stirred. A drop or two of phenol-phthalein is then added, and the mixture exactly neutralised with 5 per cent. acetic acid. The fluid is then diluted with water or alcohol (twice its volume), and sedimented or centrifugalised, the deposit being examined for bacilli in the ordinary way.

This may be taken as a type of the homogenisation methods, and it is important to notice the last step of the process, the addition of water or alcohol. This has for its object the lowering of the specific gravity of the fluid, so that the bacilli may sink to the bottom. Its importance has been especially emphasised by Dilg,[3] who finds the specific gravity of tubercle bacilli to range between 1,010 and 1,080. This method is as follows. He makes the sputum homogeneous by the addition of a few drops of ammonia, and then either lowers the specific gravity by the addition of alcohol (as above), or raises it by the addition of strong salt solutions. In the former case the bacilli sink, and are recognised in the sediment; in the latter they float, and are found in the surface-layer of the fluid.

Nebel[4] homogenises the sputum with lime-water, using about six times its volume. He then centrifugalises for two minutes, in order to get rid of the cells, fibres, etc., but not the tubercle bacilli, and filters the supernatant fluid through a Berkefeld filter. The walls of the filter are then scraped, and the material removed examined for bacilli.

The modifications of the digestive processes are numerous, and the use of an enzyme, which acts in an alkaline solution, is preferable to those which act in an acid medium, since the former dissolves the mucin. Spengler[5] adds an equal quantity of dilute soda solution, a little pancreatin, and a crystal of carbolic acid, and digests for 24 hours in the incubator. The sediment is then examined.

It is worth while to point out a fact, which should be obvious, that it is very necessary to exercise the utmost care as to cleanliness of vessels, etc., in the performance of these methods. The glass-ware used should be cleaned with strong nitric acid, or with sulphuric acid and bichromate of potash, and should be kept carefully covered, in order to prevent any access of dust whilst in use. The pipettes used in the collection of the sediment should be freshly drawn out, and it is an

advantage to use new slides on which to spread the films; serious errors have occurred owing to the neglect of this last precaution.

With regard to the recognition of the tubercle bacilli in the *urine*, Trevithick [5] finds the chief source of error in the fact that the salts in the urine prevent the bacilli from adhering to the slide. In order to avoid this he rewashes the sediment got on centrifugalisation with distilled water, with the result that the bacilli do not wash off in the staining processes. Others add a little serum to the sediment, and I am in the habit of spreading a thin film of serum on the slide, and allowing it to dry before spreading the sediment on it. As a rule, however, there are sufficient cells, etc., in the centrifugalised sediment to entangle the bacilli, and prevent them from being washed off.

A more important source of error comes in from the relative specific gravity of the bacilli and urine. If an emulsion of *isolated* tubercle bacilli, such as is used in the estimation of the opsonic index, is added to ordinary urine, it will be found that a prolonged centrifugalisation is required before all the bacilli are brought down, if, indeed, it can be accomplished at all; this being due to the fact that their specific gravity may be as low as 1,010. The addition of alcohol is not always possible, as it may cause coagulation in an albuminous urine, but, when practicable, its presence is a great advantage. The addition of salt, as in Dilg's method, might be an advantage, but if employed the sediment must be examined as well as the surface-layer, since bacilli are frequently entangled in the cells of the deposit, and, very occasionally, found in their interior.

Considerable attention has been bestowed on the recognition of tubercle bacilli in the blood, as a means for the diagnosis of general tuberculosis. The method, which has been used most, is that of Besançon,[7] Griffon and Philibert, who take 5 c.c. of blood (both clot and serum), place it in a mortar with 5 c.c. of water and 5 c.c. of soda-lye, pounding until the whole is dissolved. Then 20 c.c. of water are added, and the whole boiled for 10 minutes, and centrifugalised, the the deposit being stained for bacilli. Jousset's [8] method—the older one—consists in the homogenisation of the clot by means

of pepsin and HCl, fluoride of sodium being added to prevent bacterial growth. All these observers claim to have demonstrated tubercle bacilli by their methods, but Bergeson [9] thinks that their results were due to accidental contaminations, since he failed entirely. In three cases of general tuberculosis, I also was unsuccessful, and very few positive results have been found.

Numerous authors have described methods in which tuberculosis may be diagnosed by means of cultures of the bacillus. Two things are necessary, a suitable culture medium, and material which contains no cultivable bacteria other than tubercle bacilli. Numerous culture media, boiled liver, spleen, placenta, etc., cut in blocks, and media containing yolk of egg, being the favourite which, in the hands of the inventors, have the power of stimulating the growth of the bacillus, so that, according to some, a visible growth may occur in a few days. They have not met with general success. A similar fate seems to have befallen the methods proposed for ridding tuberculous material of other bacteria. Spengler's first method consists in exposing tuberculous sputum, etc., in a thin layer to the action of formalin for about two hours. At the end of that time, he inoculated the material on glycerine agar, and obtained a pure culture of the bacillus in 14 days. Jacques [10] and others have tried this method without success. In Spengler's second method [11] heat is used, tubercle bacilli being slightly more resistant than most other bacteria. He takes up a small nodule of sputum (the size of a little nut) on a platinum loop, and brings it near a flame. He is able, after practice, to sterilise everything except the tubercle bacilli. Lastly, Hesse [12] adds to his materials gradually increasing amounts of alkali, and finds, at a certain degree of alkalinity, that only the tubercle bacilli are left alive.

With regard to the demonstration of tubercle bacilli in pleuritic and other exudates, there are two methods; the method of "inoscopy," as it is rather unnecessarily termed, of Jousset and others, in which the fluid is allowed to clot; and the method in which clotting is prevented and the material centrifugalised. The important point is that it is necessary to examine the sediment from a large amount of fluid, 100 c.c. or more, since the bacilli are usually present in very small

numbers. When the method of digesting the clot is employed, the best process is to allow the clot to drain so as to remove a large part of the fluid, and add a little concentrated digestion mixture with some antiseptic. By this means all the solid ingredients of a large amount of exudate can be concentrated into a bulk which permits of centrifugalisation (which must be prolonged) in an ordinary machine. If this method is not used, the exudate may be received into a solution of citrate or oxalate of potash, or $\frac{1}{2}$ per cent. fluoride of sodium (as in Zebrowsky's method[13]) and centrifugalised. The objection to this is that the cells, corpuscles, etc., may be so bulky as to hide the bacilli, but there is no reason why the sediment should not be digested both with an acid and an alkaline digestion mixture.

In the diagnosis of tuberculous infections, by means of *blood changes*, we must distinguish between methods dependent on changes in the leucocytes, red corpuscles, hæmoglobin, etc., and those more subtle changes which depend upon the processes of immunity, and which are induced by the presence of the tubercle bacilli in the living body. The latter are much more difficult to investigate, but analogy with other diseases, and especially with typhoid fever, would lead us to expect them to be more valuable.

As regards the simple morphological changes in the blood in tuberculosis, little has been added recently, and the excellent summary of the literature given by Ewing may be taken as representative of our knowledge at the present day. The following may serve as a brief abstract:—

The red corpuscles and hæmoglobin show the changes characteristic of an ordinary secondary anæmia, with a moderately lowered colour-index, and no very definite morphological changes in the red corpuscles. The extent of the anæmia is, of course, dependent on the extent and situation of the lesion, and, when the latter is of small size, is often entirely absent. Further, in phthisis and other forms of tubercle, when accompanied by severe perspiration or emaciation, this anæmia may be unrecognisable, being marked by a shrinkage in the total volume of the blood. Hence a very important rule, not to gauge the improvement in a phthisical patient by the increase in the amount of hæmoglobin as

measured in the ordinary way, since this may be merely apparent, and solely due to the concentration of the blood. Apart from this, a patient with well-marked but early tubercle of the lungs may have blood entirely normal in this respect.

The leucocytes differ according as to whether the tuberculous process is simple, or is complicated with sepsis. In the former case, the leucocytes are, as a rule, present in low normal numbers, or there may be a slight leucopenia, the average number, in cases of miliary tuberculosis, being about 4,000 per cubic millimetre; and, as a rule, it will be found that the elimination mainly affects the polynuclear leucocytes, the lymphocytes being present in normal numbers, and appear, therefore, to be raised when quoted as a percentage of the total leucocytes present, of which they may form 30–40 per cent., or even more.

In tuberculous meningitis, as a rule, and in tuberculous pleurisy occasionally, there may be a marked leucocytosis, rising as high as 30,000 per cub. m.m.

When the lesion has become secondarily infected by pyogenic bacteria—as usually happens in phthisis, and may occur in most forms of tubercle—these appearances change into those of mild or severe sepsis, and all trace of the tuberculous origin is lost. The leucocytes usually show a moderate increase in numbers, this increase being due to an increased number of polynuclears.

Some attention has recently been paid to the subject of the eosinophile cells in tuberculosis, but no new results of any value have been obtained. Neisser held years ago that the more eosinophiles present the greater the degree of immunity to tubercle, and *vice versâ*. Swan[14] regarded the absence of these cells as an unfavourable prognostic sign, and the increase is an indication that the disease has a tendency to arrest itself; and Pesol[15] noticed the same to occur in several cases, whilst Ullom and Craig,[16] in an investigation on this point, thought at first that this was the case, though further investigation did not support this view, though their table certainly shows low average counts in fatal cases, and higher numbers in favourable ones.

In my opinion the question of the behaviour of the eosinophiles has very little, if any, direct relation to the tuberculous

process at all. The number of eosinophiles present varies considerably in different persons, but, as a general rule, it will be found to be decidedly higher in the healthy and well-nourished than in the feeble and badly-nourished, apart altogether from the presence of actual disease. Thus, in hospital patients of the type met with in London, 2 per cent. may be regarded as a decidedly normal high count. Lowness of the eosinophiles, therefore, may be regarded as evidence of an important, and probably the most important, predisposing cause of tubercle and of other diseases.

There is another factor in the absence, or low numbers, of the eosinophiles in the later stages of phthisis, etc., and that is the presence of sepsis, for, in all septic conditions, these cells are present in small numbers, and I have always regarded the reappearance and increase of the eosinophiles as a most important favourable omen in any inflammatory disease. Much stress has been laid on this of late in typhoid fever by Blumgart,[17] but it is even more marked in pneumococcic affections, and the presence of pneumococci, as secondary invaders in phthisis, is almost constant.

Tuberculosis cannot be diagnosed, with absolute certainty, by means of an ordinary "blood-count," but the procedure is capable of giving information of great diagnostic value when properly interpreted; the field of choice is often narrowed down, and alternative diagnoses excluded.

Arneth[18] has recently introduced a new method of blood examination, upon which a considerable amount of literature has already been published. He turned his attention to the polynuclears, which he divided into five groups according to the number of lobes present in their nuclei. In the first group, the nucleus consists of a single lobe, in the second, of two, and so on. There is a second sub-grouping of each class, dependent on the depth of the constrictions in these lobes, but this is less easy to decide with certainty, and not so important.

His normal count is as follows:—

Class	I.	II.	III.	IV.	V.
	5	35	41	17	2

Other observers have recorded results which generally

confirm Arneth's figures. Thus Grell,[19] in a very careful research executed in my laboratory, made them to be :—

1·86	33·12	51·86	12·86	1·28

Whilst Paulicek [20] gives :—

4	28	52	14	2

In infectious processes these blood-pictures change in a more or less characteristic manner, the usual rule being for the first and second group to increase at the expense of the last three; thus, in typhoid fever, a characteristic count is:—

18	40	39	3	0

The largest number of cells being in the second instead of in the third group, whilst the first has increased from 5 to 18.

Unfortunately this method seems hardly worth the trouble which it entails (which is considerable, since a certain amount of experience, and a count of at least 500 leucocytes is necessary to get blood-pictures upon which reliance can be placed), as it is quite clear that very different diseases may give similar results. In tubercle, there is the same shifting to the left as is seen in typhoid fever, and in most of the infectious processes. Thus, in a case of tuberculous peritonitis, Grell found :—

6	43·6	38·6	11·4	0

And an average of Panlicek's four cases of tubercle gives :—

16	47·75	30·5	4·75	1

Such figures might be readily paralleled from counts made of sepsis, malaria, and other diseases. The method, when more fully investigated, may not be without value, especially, perhaps, in prognosis, or in the investigation of the severity of an infectious process, but, at present, it is not a useful method in the diagnosis of tubercle.

Of specific serum reactions, which have been proposed for the diagnosis of tubercle, the following have been proposed: the agglutination reaction, the opsonic index, either simply or in one or other modifications, and the method of absorption of complement as proposed by Wasserman.

The *agglutination reaction* has not proved of much value in diagnosis, and a recent investigation has shown that tubercle in monkeys may run its whole course without the appearance of the phenomenon.[21] It is still used, though not to a large extent, in France, and a full account of the process and results

obtained may be consulted in a review in the *Bulletin of the Pasteur Institute.*

The simplest and probably best method is that introduced by Wright, the emulsion used being one of dead tubercle bacilli suspended in ·1 per cent. saline solution, in which the organisms lose to a large extent their natural property of spontaneous clumping, which has previously been such a difficulty in the way of the examination.

The value of the *opsonic index* in tubercle is still debated, and, amongst pathologists, opinion as to the exact nature of the opsonins and their relation to immunity is in a fluid state, and many problems are yet very obscure. These will not be discussed here, the scope of these remarks being limited to the practical value of the process in diagnosis.

The first question, and a most important one, deals with the degree of accuracy with which the index can be estimated. The process is a complicated one, and there are loopholes by which errors can creep in at every stage. Given accurate work, how near an approximation to the true figure can we hope to approach? English investigators, in general, agree with Wright, that the results of the process should agree within 10 per cent., *i.e.*, that the maximum error should not be more than 5 per cent. in either direction: an error which will compare favourably with those incidental to most of the measurements necessary in quantitative investigations of substances concerning with immunity. Some investigators, however, have come to very different conclusions, and consider that the possible error is so great as to render the process useless. Thus Jeans and Sellards[23] found that, by counting 50 cells in various parts of their preparations, they got indices varying from ·56 to 2·34, though they go on to admit that they got good results in treatment regulated by examinations of the opsonic index. Moss comes to similar conclusions with regard to the inaccuracy of the method, and all these observers give their technique in full, and have obviously taken great pains in all details.

Now, if these observers are correct, observations on normal persons should lead to results which should show great variation, but, as a matter of fact, we find that they do not, and all investigators find that the indices of healthy persons approxi-

mate closely to unity, having ·8 and 1·2 as limits which are rarely transgressed, and, further, that renewed examinations of the index of the same person yield very similar results. This is well brought out by the earlier English investigators, whose figures will be referred to later, and has recently been confirmed in a marked way by Hollister,[24] of Chicago, who made between 60 and 90 consecutive tests on normal individuals. This does not suggest an error of several hundreds per cent. Further, the very remarkable curves, which can be obtained with almost perfect regularity after vaccination, showing the negative phase, rise, culmination, and fall, of the index, can hardly be due to a set of fortunate and unparalleled coincidences, as they would have to be, if the error were anything like that held by the investigators at Johns Hopkins.

A practical experience of nearly three years has convinced me that the process is capable of very considerable accuracy. I am in the habit of occasionally checking my results by several methods, *e.g.*, by counting preparations, stained by my assistant, in which there are duplicates, which are not distinguished, or by getting a second person to collect my blood samples, and take duplicates of some of them, not telling me which. Occasionally also I have got another pathologist to make estimations of the same specimen and control, and our results have corresponded very closely.

The impugners of the accuracy of the method attempt to prove too much. If their arguments were correct, the results would be a mere matter of chance, and the figures might range between, say, ·5 and 2·5, entirely irrespective of the source of the blood. It is quite certain that this is not the case. For example, Dr. Whitfield has a patient whose index, as tested on some twenty occasions, is uniformly low, rarely rising above ·5, and is often so low that he can pick out the patient's blood-film from many others. I estimated this person's index on two occasions without the slightest knowledge of Dr. Whitfield's results, and got very low figures. The possibility of coincidence here is very improbable, and, if we can always get such coincidences, nothing more is required. If these authors had been content to say that the technique is a difficult one, and requires much practice and careful attention to every detail before accurate

results should be obtained, everyone would agree with them ; and I suppose every novice in the use of a laborious process, full of chances of error, is prepared to find his early results of little value.

The fullest series of clinical researches into the value of the opsonic index, as an aid to diagnosis, are those of Bulloch, Urwick, and Frazer.

First, as to the index of healthy persons. Miss Frazer, in 41 cases, found a maximum of 1·2 (in a single case), a minimum of ·8 (in two cases), and an average of ·98. This accords very closely with Bulloch's 66 cases with an average of ·96, a maximum of 1·2, and a minimum of ·8; with Urwick's 20 cases, ranging between 1·2 and ·8, with an average of 1·006, and with Lawson and Stewart's 25 cases, with limits of 1·2 (except in a single case of 1·4), and ·9, and an average of 1. We may then fairly assume that, in health, the index lies practically always between the limits of 1·2 and ·8, and that any index below or above these limits may be regarded as fairly definite evidence of the presence of some morbid process. The next question is, how does the index vary from the normal in tuberculous subjects ?

Wright's[28] earliest idea was that the index is low in tuberculous affections, but, in his later writings, he classified these diseases into (1) localised or non-progressive lesions, such as glandular tubercle, tuberculous abscess, and stationary or slowly progressive phthisis ; in these he found the index uniformly low, never above ·88 ; and (2) generalised or progressive infections, such as pyrexial phthisis ; in these he found a variable index, which might be extremely low or extremely high, and this variation he attributed to the constant auto-inoculation which was taking place from the infected areas.[28]

Further research showed that, even in the localised cases, the index might be very high. Thus, in lupus, Urwick recorded a case in which the index reached 1·9, Bulloch one of 1·4, and I have seen cases of old non-progressive lupus with indices of 1·8 and 1·7.

Miss Frazer reports observations (sometimes repeated) on 91 patients known to be suffering from tubercle. In these cases, 33 were within the healthy limits on the first examination, and of these six were abnormal on the second. In

Bulloch's series of 150 cases, 37 were within the limits, and, in Urwick's, 13 out of 54. Taking all these together, we come to the conclusion that in about 27 per cent. of all cases of tubercle a single observation of the opsonic index will yield figures consistent with health, and will afford no help whatever in diagnosis, and that, in the remaining 73 per cent., the index will show a greater or smaller deviation from the normal, which may or may not be sufficient for a positive diagnosis. In order to settle this, it is necessary to turn to observations of the index in non-tuberculous diseases. Of these, Frazer records 41 taken mostly from diseases which are known clinically to be frequently followed by tubercle, and which might be thought to alter the index in some way (diabetes, measles, whooping cough, pneumonia). In these 41 cases, five gave abnormal figures. A case of pneumonia gave indices of ·66 and ·60, and another gave ·57; one of diabetes gave ·67 and another ·69; and one of whooping cough gave 1·5. My own experience has been similar. I have once seen an index of 1·4 in basic meningitis, in which no tubercle was found in an ordinary post-mortem examination (which by no means excludes its presence), and I have found it as low as ·7 after an attack of influenza, and again in a case of pernicious anæmia, but with these exceptions, it has always been with the limits of ·8 and 1·2 in non-tuberculous diseases.

Comparing these results, we may say (1) that an index between 1·2 and ·8 tells us nothing definitely, but, since it occurs only in about 25 per cent. of cases of tubercle, raises a certain amount of presumptive evidence against the presence of that disease.

(2) An index above or below these figures is very strong evidence of tubercle, especially when it occurs in a patient, who is not the subject of any disease which lowers the general health, such as pneumonia, influenza, or diabetes.

(3) The greater the deviation of the index from the normal limits, the greater the probability of the affections being tuberculous. To make a certain diagnosis of the presence of tubercle from a single examination, it is probable that the index ought to be ·5 or lower, or 1·5 or higher. These conditions occur in about 20 per cent. of all cases of tubercle, and it is only in

about this proportion that the diagnosis can be made on a single examination.

This brings us to a second, and far more important and valuable method, that of *repeated* examinations of the opsonic index, with a view to the determination of the presence or absence of fluctuations in the opsonic level. As pointed out above, in chronic or non-progressive forms of tubercle, the index, as a rule, is stationary (though not necessarily so, as Wright once thought) at a low level, whereas, in acute tuberculosis, violent and rapid fluctuations of the index may take place. In actual practice, the index may be determined daily, or twice daily, and three or four examinations should be made, unless the first two give positive results. The greatest care in the technique is necessary.

A considerable number of cases is diagnosable by this method, but not all, the exceptions being (*a*) the chronic and latent forms, in which the index remains stationary, and (*b*) certain unusual forms of acute tubercle, in which the same phenomenon occurs. The frequency of these has not been determined, but it is certainly rare. I have known it to occur in general tuberculosis and in tuberculous meningitis.

A rapid fluctuation in the index may be taken as definite evidence of tubercle, unless there is something quite obvious in the patient's condition to account for it; thus an attack of influenza, or the onset of menstruation (Bulloch) is sufficient to determine a more or less marked fall, which might lead to confusion unless its cause is recognised.

There are not, so far as I am aware, any published papers bearing on the degree of fluctuation necessary for a diagnosis. My own practice is to regard a difference of ·4 as diagnostic, and ·3 as suspicious, but much must depend on the confidence which the pathologist has in his technique. It is obvious that an error of ·1 in each determination might lead to an apparent difference of ·2 in the two observations.

Another method of diagnosis, which is in some respect a complement to this, since it is specially applicable to those cases in which the index remains stationary, and depends on the presence of a negative phase following inoculation; this is well known as a general phenomenon in immunity, and its occurrence was pointed out by Wright, specially

emphasised by Lawson and Stewart, and suggested by them as a method of diagnosis. In practice, this method is of very considerable value, more especially since it forms a method which is competent to diagnose the *absence* of tubercle. In the other opsonic methods negative results are of comparatively little importance, and do not exclude the presence of tubercle or of even active tubercle. There is now a sufficient amount of evidence to show that the negative phase after the injection of a sufficient amount of tuberculin is a *constant* phenomenon in tuberculous diseases, and that it is absent in health, or in non-tuberculous affections.

The technique is simple, but it involves at least two careful determinations of the index. The normal level is first determined, and here it is advantageous to make at least two observations at intervals of 24 hours; then an injection of $\frac{1}{1000}$ mg. of new tuberculin is given, and another observation made in 12, and, if possible, a third in 24 hours. A drop of ·4 may be taken as being diagnostic, but it is often much greater than this.

Wright also makes use of the method of auto-inoculation for the purpose of eliciting the negative phase for diagnostic purposes, the lesion being massaged, or otherwise manipulated. This appears to have no advantage over the injection of tuberculin, which, in the dose mentioned, is entirely devoid of danger.

The last serum-test calling for mention is that introduced by Wassermann.[30] It depends on a phenomenon, discovered some years back by Bordet and Gengou,[31] and found to be of very general application. This phenomenon, which is often, though incorrectly, termed "the deviation of complement," consists in the absorption of complement by the substance formed by the interaction of an antibody and its antigen. For example:—If serum from one animal, *e.g.*, from man, is injected into a rabbit, the latter develops an antibody, in this case a precipitin, which combines with the human serum. Now it is found that this compound of human serum (the antigen) and precipitin (its antibody) has the power of uniting with any complement present in the mixture, and this happens even if the antigen is present to so small an extent that no visible precipitate is formed. It follows, therefore, that, in

place of using the formation of the precipitate as our criterion for the presence of human serum when tested with a serum containing precipitin, we may see whether complement is absorbed, or (and this is the application that is of use in the diagnosis of tubercle), we may see whether the addition of an antigen to a given serum removes complement: if so, there is an antibody present, and if the serum is tested in this way with tubercle bacilli, and we find that it contains an antibody to this bacillus, we may infer that the patient is infected with tuberculosis, since in no other way are antibodies to tubercle likely to be produced.

The method of testing is difficult and elaborate, and this will prevent the test from coming into general use. It may be outlined as follows:—First, the patient's serum is heated (to destroy complement), and to it is added an emulsion of bacteria (the antigen) and normal serum from an animal (containing a complement, which will activate the hæmolytic amboceptor used subsequently). If the patient's serum contains an antibody to tubercle, this will combine with the tubercle bacilli, and will fix this complement.

Secondly, the serum of a rabbit which has been immunised to red-blood corpuscles of another species (*e.g.*, man) is heated, and added to an emulsion of these red corpuscles, which are now activated or prepared to undergo hæmolysis on the addition of a suitable complement. This is allowed to stand for a time.

Thirdly, the first mixture is added to the second (and in practice it is necessary to work with several dilutions), the resultant incubated for an hour or so, and placed in an ice-chest to settle. If there is any antibody to tubercle present, there will be no hæmolysis, whereas, if it is absent, hæmolysis will take place.

If there is no antibody, the presence of tuberculin, or other products of the tubercle bacillus may be investigated on similar lines, using a serum known to contain antibodies to tubercle instead of the patient's serum in the first part of the experiment, whilst the patient's serum takes the place of the emulsion of tubercle bacilli.

At present but few observations have been made on the application of this process to the diagnosis of tubercle, and the

method is noted as being of great theoretical interest and future promise, rather than one of immediate practical use. Brück [32] has recorded a case of a patient with general tuberculosis, in whose blood tuberculin (or other products of the tubercle bacillus) was found by this method in the early stage, whereas, after a time, an antibody made its appearance, and just before death tuberculin again. In localised tubercle neither appears to occur in the blood, though both are or may be present in the tissues.

In other infections, however, the method has already proved of value, enabling the nature of a disease to be investigated, when the infecting agent is not demonstrable.

Two special applications are of special interest, viz., the proof of the syphilitic nature of tabes and general paralysis, and the diagnosis of gonorrhœal arthritis and other forms of gonococcus infection, where the organism cannot be obtained. In the case of syphilis the antigen (taking the place of the emulsion of tubercle bacilli in the technique described above) is obtained by using the tissues of a syphilitic fœtus.[33]

The diagnosis of tubercle by means of *tuberculin* is still employed by many clinicians, though the large doses formerly employed have been abandoned, and small ones, or more usually a series of increasing doses substituted. Space would not admit of an abstract of the papers published on this subject in recent years, but reference should be made to two modifications, which have recently attracted some attention.

V. Pirquet [34] studied the effects of a second (Jennerian) vaccination shortly after the first, and found that it underwent an unusually rapid evolution, forming a flattened papule, which might attain a diameter of one-fifth of a centimetre, and which attained its maximum in four days. The lesion is so small that it is necessary to make a control inoculation without the use of lymph, or it may be overlooked.

V. Pirquet was led, by theoretical arguments, to regard the reaction as a general one, and as analogous to the local reaction met with after the injection of tuberculin or mallein, and devised a method, by which it might be applied to the diagnosis of tubercle. He placed two drops of old tuberculin "diluted" on the skin, which was then gently scarified. He found in children, who were tuberculous, a reaction, consisting of the

formation of a papule of a light, or dark red, colour, which lasted about a week. Healthy children, or those devoid of tubercle, did not react, and patients in the last stage of miliary tubercle, tuberculous meningitis, or tuberculous cachexia generally might also fail to react. With these exceptions, his experience of 500 cases was that it afforded an unerring means of diagnosing tubercle in the early years of childhood. In older patients, reactions were more frequent, and almost all adults react: this he explains by the known prevalence of mild or healed tnberculous infections in later life.

There is already an extensive literature dealing with the subject, and the results recorded have in general been satisfactory. The operation is a trivial one, and appears to be entirely devoid of danger, and might well be tried in doubtful cases. My own experience with this method has been small, but I have had, at least, one failure in a tuberculous patient, who was not cachetic, and one reaction in a child in whom there was no clinical evidence of tubercle, though, of course, that goes for little. If the method is as delicate as it is claimed to be, an objection may arise that it may be misleading, and that a patient, who has a small and quiescent tuberculous gland, may be thought to have tuberculosis, when he is in reality suffering from typhoid fever, or some other complaint.

A modification of von Pirquet's test, first introduced by Wolff Eisner,[35] and more fully investigated by Calmette,[36] consists in the instillation of old tuberculin into the conjunctiva. If the patient is free from tubercle no reaction occurs; but, if there is a tuberculous deposit, even latent, anywhere in the body, the conjunctiva becomes congested in 3 to 5 hours, the caruncle becomes œdematous, and there is a little fibrinous secretion in the lower conjunctival sac. The reaction attains its maximum in 6 to 10 hours, and disappears in 24.

Calmette's fluid is sold ready prepared, and consists of old tuberculin precipitated by alcohol, dissolved in sterile distilled water, and sterilised by boiling. Calmette has reported 426 cases (infants and adults) examined in this way with definite results in all cases, except in those who were moribund, and in whom no defensive reaction was to be expected. He emphasises the fact that redness of the conjunctiva and fibrinous exudation are necessary for a positive

reaction ; a mere temporary redness of the conjunctiva does not imply the presence of tubercle. Sabrazès and Dupérié have also reported 24 cases with good results.

Chantemesse [37] has also applied a similar method to the early diagnosis of typhoid fever, and the process seems likely to lead to far-reaching results.

In this method also my experience has been but slight, but it has led me to believe that the reaction is one of some value, but that it is very far from being devoid of danger, since an acute and severe conjunctivitis, which may lead to keratitis and corneal ulcer, may follow a positive reaction. In one case in which I practised the method, the reaction occurred, but did not subside, and the patient developed an acute conjunctivitis, in which Mr. Stephen Mayou found the Koch-Weeks bacillus. A nurse in the ward was also found to be suffering from slight conjunctivitis, in which the same organism occurred. It is evident that the reacting conjunctiva has its resistance lowered, and is easily infected, and, for this reason, I should be very chary of practising the method in future. In eye cases the testing of the reaction on the sound eye seems too full of danger to be employed. Several cases of severe ulceration, and even total loss of sight, have been recorded.

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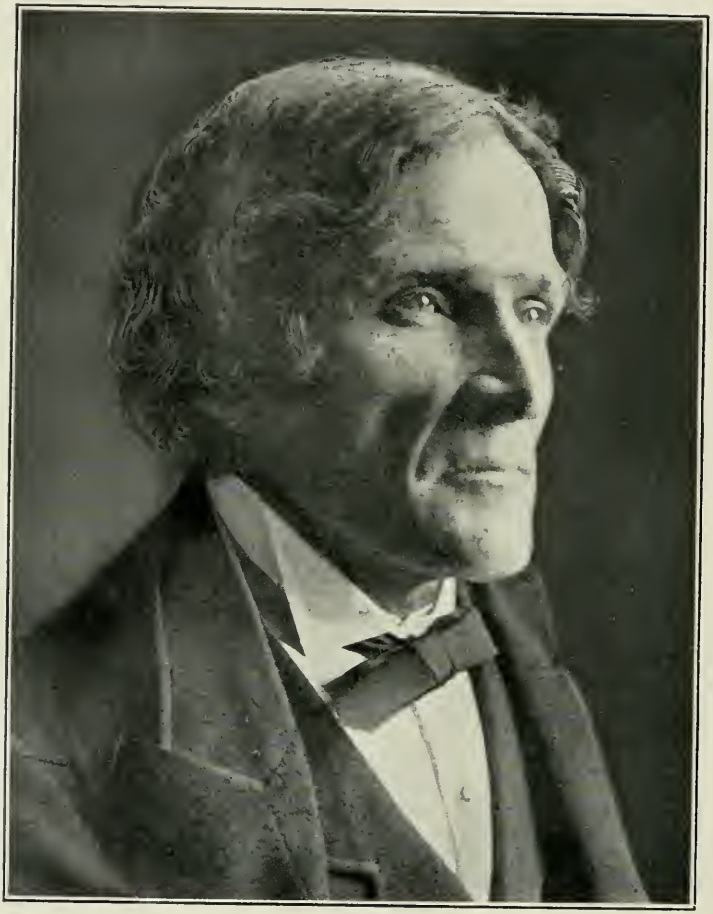

Yours very truly

J. Burdon Sanderson

LEADERS IN MODERN MEDICINE.

VI.—SIR JOHN BURDON-SANDERSON.

[With Plate XVIII.]

RATHER more than two years ago, there passed away from our midst the great master in medicine, whose name stands at the head of this article. Sir John Burdon-Sanderson had a long and strenuous life, and he retained to the end his intellectual vigour. Although his work was mainly directed into physiological channels, and he is best known as Professor of Physiology at University College, London, and subsequently at Oxford, yet he studied his subject in no narrow groove, but his sympathies and, in some cases, his teaching extended to other branches of biological and medical science. He was a man of striking personal appearance; his nature was one which was singularly sympathetic, and at the time of his death, the usual biographical notices which appeared in the medical press were supplemented by reminiscences of a more personal nature, which were written by numerous friends who had been either his colleagues or his pupils. Together these formed a very remarkable piece of testimony to his widespread influence in science, and to the affection and enthusiasm with which he inspired those brought into contact with him. The interest he took in young men was one of his most characteristic traits. At such meetings as those of the Physiological Society, which he attended with regularity until the last, he listened to the communications and demonstrations with the keenest attention, and to the junior adherents of the Society he always gave either a word or encouragement or a helpful piece of criticism. He followed the recent advances of science so closely, and was such a mine of information on the literature of all branches of physiology and pathology, that investigators felt sure of assistance, when they placed before him the problems they were working at, and of a stimulus to renewed endeavours.

Many stories are told of his forgetfulness in little matters;

most of these are either exaggerations, or are entirely apocryphal. When he closed his eyes during a lengthy debate, he was not asleep, for it was often then that he would surprise the audience by an unanswerable piece of criticism.

One does not, however, want this article to be a mere réchauffé of the obituary notices, which have already appeared, nor a repetition of the many kindly words which were penned by those who knew him well, and which re-echoed in the hearts even of those who only knew him slightly. The purpose of this little memoir is rather an attempt to form a judgment of the permanent value of his work, and of the mark he has left in the various branches of medical knowledge to which he devoted his life. After the lapse of such a short time since his death, it is not altogether easy to accomplish this task ; those who write later will doubtless obtain a truer perspective. To do this in more or less logical sequence, it will be convenient to take first his work in physiology proper, for it was physiology, the study of function, that always came first with Burdon-Sanderson. We can then pass on to consider his influence on pathology, medicine, and public health, and finally what he accomplished in what may in general terms be described as medical politics.

The earliest paper which Burdon-Sanderson produced was on the metamorphoses which blood-corpuscles undergo, and on the influence the spleen is supposed to exert on these changes. This was published in the *Edinburgh Monthly Journal of Medical Science* for 1851, and it exhibited, what subsequently became such a marked feature in all his writings, the faculty of correct observation, and the devising of new methods to render observations exact and capable of measurement. Another early paper dealt with the best means of restoring the apparently drowned, an inquiry which was set on foot by the Royal Medical and Chirurgical Society. Burdon-Sanderson's experiments led to the adoption of the Sylvester method by the Royal Humane Society. He subsequently took up the whole question of asphyxia, and his work on the influence of respiration on blood pressure not only provided physiologists with the proper apparatus for further work on this subject (that is, the proper machinery for recording and measuring

the movements), and gained for its author the Fellowship of the Royal Society, but laid a permanent foundation for all our subsequent knowledge on the subject. He felt that "no real advance can be made until it is possible to investigate phenomena by methods approaching more or less closely to those of the physicist in exactitude." In no department of his work was this precept better exemplified than in his memorable researches on the heart, and the nature and time relations of the excitatory process which underlies cardiac activity. This work extended over many years, and formed the subject of numerous memoirs which were published by the Royal Society. Some of this work has, up till now, had no bearing on practical medicine, for much of it is related to the electrical sign of life. But as a contribution to natural knowledge, and as a pattern of exact observation and logical reasoning, there are few researches to equal it. As new instruments of precision were introduced, such as the rheotome and the capillary electrometer, each in turn was employed to make the experiments more complete and perfect.

In the earlier part of his professional life, Burdon-Sanderson was a keen student of botany, and at one time lectured on that subject at St. Mary's Hospital. To the last, vegetable life was an aspect of biology very near to his heart. He was, therefore, fully equipped to undertake a piece of work originally suggested to him by Charles Darwin, on the excitatory processes occurring in the sensitive plants. One of the most laborious of these investigations was that carried out on the leaves of the Dionœa, and it also extended over several years. He found that the response to stimulation of the excitable hairs of the leaf was associated with marked electrical changes, which indicate excitatory processes occurring in the leaf-cells.

The attraction that electro-physiology always had for Burdon-Sanderson reminds one that Du Bois-Reymond, of Berlin, always manifested the same predilection. The two men also resembled one another in the trustworthiness of their observations, and in their resourcefulness in devising experimental methods. Both recognised that the most precise information, as to the character of a process in an active tissue, is that given by the electrical accompaniment of such process,

and led them to the study of these changes in muscle, nerve, and in the electrical organs of fishes. The main results in relation to muscle formed the material for one of Burdon-Sanderson's Croonian lectures before the Royal Society. Another important memoir on the electrical fishes, written in conjunction with Professor Gotch, his successor in the chair of Physiology at Oxford, was the outcome of their work at the marine biological stations at Plymouth, St. Andrew's, and Arcachon.

In the region of bio-chemistry, Burdon-Sanderson never produced anything noteworthy in the shape of original research. He was nevertheless well versed both in chemical knowledge and technique; in his early days he studied chemistry with Würtz in Paris. He was one of the first in this country to make the chemical side of physiology an important department of his teaching, and the practical exercises in this subject, which he prepared for the use of students, still form the basis of the more elaborate text-books which are in vogue to-day. It was his insight into the meaning and importance of the chemical processes of the body, that acted as one of the inspirations that has led British physiologists to bestow so much attention to this branch of science. His influence on the teaching of general physiology has also been immense, for it is to him that we owe the introduction of the now universal practical class. Previous to his election to the chair at University College, London, the students were taught the subject almost entirely by lectures, supplemented by a few microscopic demonstrations, which were introduced by his predecessor Professor Sharpey. To the practical and experimental classes, which Burdon-Sanderson introduced, he attached great educational value; amongst other things they teach at any early stage in the student's career that cultivation of the use of the fingers, and of the powers of observation and reflection, which the practice of both medicine and surgery demands. In the present time it is not necessary to labour the importance of practical instruction; one is apt to forget, however, the difficulties of the pioneers who instituted the adoption of what, in the early days, was a revolutionary method.

The foregoing paragraphs do not pretend to give a complete

account of what Burdon-Sanderson did in the making of physiology and in the teaching of his subject. What has preceded this merely gives what one may term samples of the important work which filled his days. Physiology is the handmaid of medicine, besides being an end in itself, and all increases of knowledge, even if their practical utility is not immediately seen, must ultimately find an application when looked at from the more utilitarian point of view. But Burdon-Sanderson did more than merely explore the more recondite branches of physiological learning. His work in medicine, and especially in that branch of medicine we call pathology, was sufficient in itself to have made his name famous. Early in life he practised as a physician, and held clinical posts both at the Middlesex and Brompton Hospitals, and during the closing years of his life he became, on the death of Sir Henry Acland, the Regius Professor of Medicine at Oxford. It was felt when this appointment was made that Burdon-Sanderson would not only occupy this honourable post with distinction (a forecast he abundantly fulfilled), and that he was qualified by his acknowledged scientific reputation to fill such a position, but also that, in view of his researches in pathology, the election was justified from the more strictly medical standpoint.

His work on Inflammation, published in Holmes' *System of Surgery*, and on Fever in Clifford Allbutt's *System of Medicine*, are two only of the important contributions to pathology which he made even at a time when his work was mainly physiological. Long before the discovery of the tubercle bacillus, he arrived at the conclusion, from his experimental work carried out in conjunction with Dr. Klein, that tubercle was an "infective" inflammation. His distinction between infective and non-infective inflammation was the first clear recognition of differences in the pathogenicity and virulence of the same micro-organism under different conditions. His work further extended into the ætiology and pathology of pyæmia, erysipelas, and other diseases of man, and to the infectious diseases of animals, such as pleuro-pneumonia in cattle, and anthrax. He was many years before his time when he adduced evidence that immunity against pleuro-pneumonia in cattle could be produced by administration

of the virus, and, at the conclusion of his paper on anthrax, he wrote: "The question whether this fact, like the analogous one of the mitigation of human small-pox by transmission, can be directly applied to a practical purpose, I leave to be determined by future inquiry." It was only three years later that this prophetic forecast was fulfilled by the introduction of Pasteur's protective inoculation against this disease.

It is not perhaps very easy for the younger pathologists of the present generation to realise that there was a time, and that really not a very distant one, when the causal relationship between micro-organisms and disease was a debatable point. All honour, therefore, to those far-seeing and correct thinkers, who, like Pasteur, Lister, and Burdon-Sanderson, arrived at a true insight into the situation, in spite of the formidable opposition which existed against them.

It was about this same exciting period that another question aroused keen contention, namely, that of spontaneous generation, and it is significant that Burdon-Sanderson did not range himself among the opponents of that doctrine until he had himself repeated the fundamental experiments on which that theory was supposed to rest. That nature's secrets must be wrested from her by the method of experiment was as truly Burdon-Sanderson's motto as it was that of his great predecessor Harvey.

The catholicity of Burdon-Sanderson's attainments is further illustrated by the fact that, at one time, he occupied the position of medical officer of health; in fact, his appointment was one of the earliest, when these posts were established in the metropolitan districts more than half a century ago. His life then, and subsequently, is an excellent example of the advantage, which may accrue to the public by maintaining a close union between curative and preventive medicine, and between the work of the laboratory, and its practical application for the purpose of sanitary administration. While serving in this capacity, he assisted the Government in systematising the working of the Vaccination Acts; and the present medical department of the Local Government Board was in no small measure the outcome of his advice. It was he, in conjunction with Simon and Buchanan, who first encouraged researches on the cultivation of the vaccine virus outside the human body.

His name is further intimately connected with the study of cattle plague, and with the isolation of the true contagium of that disease. It was fitting that, towards the end of his life, he was selected by the University of Oxford to represent them on the Council of the British (now the Lister) Institute of Preventive Medicine. He always took an active part in the deliberations of the governing body of the Institute, and it was largely owing to his influence that the department of physiological and pathological chemistry there was founded.

This, however, was only a small share of the influence he exerted for good in the realm of medical politics. He was, among other things, prominent in raising the standard of examinations for degrees in public health, and in insisting that candidates for this degree should not only have laboratory experience, but a really practical knowledge of organisation and of sanitary administration. Closely connected with this, were his endeavours to raise the status of veterinary surgeons, and the recent institution of degrees and diplomas in veterinary science in some of our universities must be traced to his wise and far-seeing advice.

It was the University of Oxford which most directly benefited by his powers of administration and persuasion. It is to this that the University so largely owes its recent expansion as a medical school. He it was who induced this ancient seat of learning to institute a lectureship, and subsequently a Professorship, of Human Anatomy. The same course was followed later in connection with the Professorship of Pathology; it was to him that the remodelling of the courses of instruction in chemistry was due; and the recognition of pharmacology as an offshoot of physiology sufficiently important to demand a teacher, who had specialised in it, was another of his useful innovations.

The most strenuous time through which Burdon-Sanderson passed at Oxford occurred shortly after his election to the Waynflete Chair; at that time Oxford had a Professor of Physiology, but no laboratory for him to work and teach in. Burdon-Sanderson's fight with the anti-vivisectionists on this question was a prolonged and anxious one. The story has often been told, and space forbids more than a brief reference to it in passing. The tactics of the opponents

of science were, as they so often are, mean and petty, for instance, the opposition to an annual allowance for water, gas, and coal, after the money for the building and equipment had been voted. But the famous struggle ended in a still more famous victory; it cannot be doubted that Burdon-Sanderson's high character was an important factor in assisting the cause of truth and justice which he championed so valiantly.

The importance and value of a man's work cannot be estimated solely by a record of his achievements, whether they be political, literary, or scientific. There is, in addition to all that, his personal influence; this is not amenable to ordinary standards of measurement, but is probably more far-reaching than anything else. Sir John Burdon-Sanderson's personal magnetism attracted all searchers for truth, and his works will live after him in the acts of those, who had the rare fortune to be inspired and stimulated by so great and good a man.

The portrait which accompanies this article is from a photograph taken by Prof. E. A. Schäfer about 1885. We are indebted to Prof. Schäfer for leave to reproduce this striking and characteristic portrait.

Reviews of Books.

Light and X-ray Treatment of Skin Diseases. By Sir MALCOLM MORRIS, K.C.V.O., F.R.C.S. (Ed.), Dermatologist to King Edward the Seventh's Hospital for Officers; Surgeon to the Skin Department of the Seamen's Hospital; Consulting Surgeon to the Skin Department, St. Mary's Hospital; and S. ERNEST DORE, M.D. Cantab., Assistant in the Skin Department, Middlesex Hospital. Pp. 172. Twelve plates. London: Cassell & Co.

THIS small volume contains a very clear account of a large amount of careful work. The authors were pioneers in the light treatment in this country, and have acquired a first-hand experience which entitles them to speak with authority on the subject. Rather more than the first quarter of the book is devoted to technique and general consideration, after which occurs a comprehensive discussion of the results of the treatment of lupus vulgaris with the Finsen light and the X-rays respectively. This is perhaps the most interesting and important part of the book, and the authors are to be congratulated on the discreet and moderate tone of their views. We note that, on the whole, they consider the Finsen light a much more powerful weapon than the X-rays for the fight against lupus, and in this we are in full agreement with them. It is important that this view should be widely disseminated, since many publications in favour of the X-rays seem to have given rise to a widespread but unfounded belief that they are as efficient as Finsen's method. The treatment of rodent ulcer and other malignant affections is well discussed, and there is a very complete chapter on the treatment of Ringworm by means of the X-rays. The authors do not express a very decided opinion as to the value of the Sabouraud pastille, but their statistics seem to indicate that its value is perhaps greater than they realise. The book is so concise and readable that it should be widely read even by those whose practice brings them but seldom into contact with the class of disease concerned, and the authors are to be congratulated on having produced a thoroughly trustworthy epitome of the subject.

A Handbook of Skin Diseases and their Treatment. By ARTHUR WHITFIELD, M.D., F.R.C.P., Professor of Dermatology in King's College, London. Pp. 320. London: Edward Arnold.

THE scope and limitations of this little work on diseases of the skin are indicated by the author in his preface. Believing that there is still a place for a concise book suited to the needs of the student and the general practitioner, he has endeavoured to fill it with the present volume. In this respect the book most admirably fulfils the purpose of its author. It is essentially practical; diagnosis and treatment being among its main features. It bears throughout the impress of the author's own wide personal experience and acute observation, and the methods of treatment advised are those which he himself has used and found efficacious. The practitioner will find its pages abounding with useful suggestions and hints for treatment, and the reproductions of photomicrographs, taken from freshly prepared or extempore specimens, will be found very helpful, as also will the numerous excellent illustrations of skin eruptions from the author's own photographs of cases.

Special attention is given to modern methods of treatment, and, in the author's own words, the results of a systematic application of the numerous investigations and methods of clinical pathology, introduced by Sir A. E. Wright, which are peculiarly applicable to dermatological practice, are here given for the first time. In regard to boils and other forms of staphylococcic follicular infection, the author says that Wright's method of vaccine treatment is of immense value, but that it is as yet too soon to say definitely how long the good effects of the treatment last, and that in patients, who habitually suffer from boils, it is necessary to repeat the course occasionally. In acne vulgaris, he tells us that the treatment "sometimes" acts marvellously. In eczema, with complicating furunculosis, he has had results unobtainable by other means. In regard to the tuberculin treatment of lupus vulgaris, we gather that, although a certain amount of improvement takes place in most cases, cures are not effected by Wright's method alone, and that it is best used in combination with Finsen, or with X-rays. The X-ray treatment of ringworm is described in detail, and the effect of the application of X-rays in various other skin affections, acne, rodent ulcer, warts, etc., is referred to when the treatment of those complaints is discussed.

Dr. Whitfield's remarks upon blood-coagulability in certain skin diseases —such as acne, chilblain, lupus erythematosus, dermatitis herpetiformis, urticaria—are interesting, though somewhat brief.

We observe with satisfaction that Dr. Whitfield classes as pyogenic infections of the skin certain forms of chronic dermatitis, which have for long been recognised as chronic eczemas, but which are now coming to be recognised as due mainly to local infection by pyogenic organisms. But we are disappointed to find that, on a later page, he relegates them again to the domain of chronic eczema. We had hoped for a fuller and more explicit treatment of the important group of Seborrhœic Dermatitis and the Seborrhœids. The chapters on Tuberculosis and on Syphilis are especially well done, and the photographs of the various syphilitic eruptions are particularly striking. We are in agreement with Dr. Whitfield, when he says that, in the treatment of syphilis, it is better to wait until the diagnosis is assured, even until the appearance of the rash, not depending upon the characters of the sore alone. We do not agree, however, that the treatment of syphilis by insoluble mercury injections is unjustifiable and to be relentlessly dismissed.

One little correction we should like to make. The female acarus scabiei has four anterior legs provided with suckers, and four posterior legs with vibrissæ, not eight legs each with a long vibrissa.

Those who make a special study of diseases of the skin will regret that Dr. Whitfield has not written a larger text-book.

Fevers in the Tropics: their Clinical and Microscopical Differentiation. By Leonard Rogers, M.D., F.R.C.P., F.R.C.S., I.M.S., Professor of Pathology, Medical College, Calcutta. London: Oxford Medical Publications. 30s. net.

In this volume, Dr. Rogers has written an original account of fevers in the tropics, in which he includes the Milroy Lectures on Kāla-Azār, which he delivered in 1907 before the Royal College of Physicians. His account is mainly based on the notes and charts of some 2,000 cases,

Dr. Frank E. Taylor, the writer of the review of Jellett's "Short Practice of Gynæcology," which appeared in our April number, states:—

> "I was in error in stating that the illustrations were for the most part borrowed from well-known sources. The presence of so large a number of beautiful illustrations borrowed from the works of Kelly and Cullen, which are well known to all gynæcologists, was responsible for this impression. On counting the actual numbers, however, I find that nearly three-quarters of the illustrations are original, having been specially drawn for this volume by Mr. S. A. Sewill."

in which he has personally examined the blood by modern diagnostic methods. Nothing can be more striking than the brilliant successes, which have resulted from the application of scientific methods to the study of tropical fevers. These methods have already led to a greater increase in our knowledge of these fevers than generations of clinical observation, and are rapidly bringing order out of chaos. Further research is, however, yet demanded on the still undifferentiated fevers of hot climates.

Dr. Rogers first traces the evolution of our knowledge of Indian fevers, and then devotes an excellent section to the technique of the examination of the blood in fevers, before taking up the systematic description of tropical fevers, which he divides into two main groups, viz., fevers of long duration, and those of short duration. Of the former group Kāla-Azār, on which Professor Rogers has done much original work, is treated at greatest length. Of the causative parasite, he considers that "the organism differs from all hitherto known flagellates, so may most conveniently be called the Leishman-donovani," and that it is transmitted by the bed-bug. He also gives a detailed description of the early stages of this disease which have hitherto not been recognised. The fever, which constitutes the pre-suppurative stage of amœbic abscess of the liver, and its rapid cure by the exhibition of large doses of quinine, are also here described for the first time. Trypanosomiasis and sleeping sickness, typhoid fever, including paratyphoid, as it occurs in the tropics, relapsing, tick and Malta fevers, and epidemic dropsy are all adequately described. Amongst the short fevers we find malarial fevers, yellow fever, dengue, plague, sunstroke, the "seven day fever" first differentiated from malaria by the author, and the "three day fevers" recently recognised in India.

We have said enough to show that this work is a most comprehensive and authoritative one, which will long remain a standard authority on fevers in the tropics.

We think, however, that the publishers have made a mistake in issuing this book in royal quarto with thick paper, so as to weigh $4\frac{1}{4}$ lbs. It thus becomes a book for the library, rather than for the travelling trunk.

An Index of Treatment, by Various Writers: Edited by Robert Hutchison, M.D., F.R.C.P., Physician to the London Hospital, etc., and H. Stansfield Collier, F.R.C.S., Surgeon to St. Mary's Hospital, etc. Pp. 877. Bristol: John Wrigh & Co. 21s. net.

It is obvious, from the nature of this work, that it has been compiled for the man in general practice, and it is to such that we heartily recommend it. Some of the most experienced physicians and surgeons of the present day have contributed articles, which, without exception, are all exceedingly good and practical, and, when we notice special articles written by such distinguished writers as Sir Thomas Clifford Allbutt, Dr. John Rose Bradford, Dr. William Bulloch, Sir James Sawyer, Dr. David Drummond, and Mr. Ernest Lane, these must speak for themselves. It is without doubt one of the best productions of its kind, and certainly one which a general practitioner can ill afford to be without. In fact, we will even go so far as to say that we consider that such a useful book of treatment should be on the bookshelf of every medical man.

Notes by the Way.

We hope to be settling down in our new building before the next issue of The Practitioner is published. The number itself will announce the new address.

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The Detention of Female Inebriates.

The Press published in April some correspondence between the Clerk of the London County Council and the President of the Eugenics Education Society on the subject of the detention, in asylums, of irreclaimable female inebriates. It is urged with emphasis on the one side that such persons ought to be detained; it is urged with equal emphasis on the other side that it is not the business of the Municipality to detain them at the cost of the ratepayer. The two propositions are not contradictory, and it is possible to accede to both of them. We have already given our support in principle to Sir James Crichton-Browne's contentions, and need not travel over that ground again. The proper deduction from his latest letter is not so much that the municipality of the metropolis is shirking its responsibilities as that legislation allocating the disputed responsibility is urgently required. It is the "view" of the Council, according to Mr. Gomme, that the provision of accommodation for incorrigible drunkards is the duty not of the local but of the central government. He adds that the Home Secretary has never dissented from the "opinion" expressed. Very likely not. But the matter is surely not one in which it ought to be possible for "views" and "opinions" to be bandied in this way. Whether the duty of taking charge of the incurable victims of alcoholism devolves upon the State or the Municipality is a detail of minor consequence. What is essential is that the State should either definitely accept the duty, or definitely assign it, and that it should be made impossible for one of the most important functions of government to remain unfulfilled, as the result of a quarrel about money and machinery.

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The Treatment of Mental Diseases.

Another question on which there has been a good deal of discussion during the past month is the proposed provision of departments for mental diseases in general hospitals. The difficulties

to be surmounted before such a measure can be taken with any useful result are well tabulated by Dr. Mercier, in a letter to the *Times*. The admission of insane patients to the general wards, he points out, would bring the hospitals under the Lunacy Acts, and "grave difficulties of administration would arise" in consequence.

* * * * *

The Taint of Insanity.

THE most interesting passage in Dr. Mercier's letter is a protest against the "stigma" commonly held to attach to mental maladies. "If," writes Dr. Mercier, "a man becomes infected by the poison of typhoid fever, we do not consider that the attack of fever attaches to him a taint or stigma after his recovery, even though, at the height of the fever, he was delirious—that is to say, insane; but if he becomes infected by some other poison which produces delirium, without the physical symptoms of fever, then, after his recovery, he is tainted, he is stigmatised"; and this popular distinction seems to Dr. Mercier an "ignorant and pernicious prejudice." Popular prejudices on scientific subjects are, indeed, nearly always ignorant, and frequently pernicious; but the parallel which Dr. Mercier draws with the view of removing this particular prejudice is not quite a fair one. When a patient recovers from typhoid, however delirious he may have been when the fever was at its height, there is, at any rate, no doubt about his recovery. The delirium obviously resulted from physical conditions which have obviously disappeared. The conditions, and the delirium, may, of course, recur as the result of a fresh infection; but the infection implies no antecedent mental abnormality, and leaves no permanent mental abnormality behind it. We do not ask ourselves whether the patient is really cured, or wonder what he will be up to next. The case of the mental patient, properly so called, is different. His return to sanity is in many cases only apparent, or only temporary. Even alienists cannot be sure of distinguishing between the complete and actual and the apparent and partial cure. Their mistakes have often resulted in the release from asylums of homicidal maniacs, who have speedily resumed their homicidal practices. The public know that, and their knowledge is the *rationale* of the prejudice.

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The Enlightened View.

It is a prejudice which, Dr. Mercier tells us, does not exist in some enlightened countries. He relates a story of a "well-known professional man" in the United States who spent some time in an asylum under treatment for mental derangement, and whose professional friends afterwards "entertained him at a banquet to celebrate his recovery." We hope he had indeed recovered; but we have heard of a case in which a mental patient, discharged from an asylum as cured, refused an invitation to a similar congratulatory banquet on the ground that he was the moon, and had to shine that night. Until alienists are in a position to assure us that such stories not only are not, but cannot be, true, the popular prejudice is likely to remain ineradicable, whether it be pernicious or not; and, so long as that prejudice exists, the proposal to treat mental cases in general hospitals is impracticable.

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Hygienic Facilities.

The Lord Mayor of Melbourne, opening the Public Health Exhibition at Islington, had some interesting things to say upon the contrast between British and Colonial hygienic facilities. "In Melbourne," he said, "every labourer had his four-roomed cottage, and the municipal authorities took care that every cottage had a bath-room." In Melbourne, therefore, we may suppose, they have no story corresponding to that of the cabman, if he was a cabman, who is said to have said that he would "no more think of washing his head than of washing his feet"—or *vice versâ*. They are lucky if they have not; and it is, of course, one of the advantages of a new country that it can make a clean start in every sense of the word, whereas an old country has to deal with architectural conditions dating from the days when cleanliness was regarded as a luxury and a class distinction. In theory, of course, we have long advanced beyond that conception of cleanliness; but it remains for us to bring our practice closely into line with our theories. Perhaps it would be premature to demand that all houses without bath-rooms should be condemned as insanitary dwellings; but the time may come before very long when even that ideal will be realised.

Practical Notes.

Alcohol in the Treatment of Pneumonia.—It is not so very long ago that alcohol, in large doses, was prescribed as the routine treatment for cases of acute croupous pneumonia. There is no doubt that these large doses of alcohol were responsible for many causes of delayed resolution, or for even some permanent damage to the lungs. In some cases, the alcohol increases the toxæmic symptoms, and may even cause uræmic symptoms to appear. It sometimes produces great restlessness, excitement, or even delirium, and occasionally does away with the desire for a more useful form of nourishment. If it is necessary to stimulate the heart and increase cardiac tone, strychnine and digitalis will be found to be safer and more useful than alcohol. At the same time, it must be remembered that acute croupous pneumonia is a particularly fatal disease in those addicted to alcohol, and in these cases it is frequently necessary to employ alcohol as a drug in the course of treatment. Dr. William Ewart writes that, far from advocating the regular administration of alcohol in pneumonia, he seldom recommends it in ordinary cases, except as a restorative at the stage of invasion, or in states of exhaustion, or during the period of disablement of the digestion, when whey is prescribed as an exclusive diet. As an opportune dose of alcohol may be of the greatest service in tiding over any dangerous depressions, he is opposed to the hard-and-fast rule which would deprive the patient in the hour of need of the most effectual of our temporary stimulants. The conclusions to be drawn, therefore, are that the routine treatment of acute croupous pneumonia by large doses of alcohol is unsound, that to say that alcohol is never required in any case is quite wrong, but that to aim at the happy medium, by prescribing it in efficient doses, when there are particular indications for its use, is at once a wise and prudent course.

The Rôle of the Gonococcus.—Ever since its discovery by Neisser, it has been universally recognised that the

causative agent in the production of gonorrhœa is a specific micro-organism, the diplococcus gonorrhœa, or the gonococcus. It is, however, less universally recognised that this organism plays a much more extensive rôle as a factor in the production of disease, and more recent researches have shown that it may be almost ubiquitous in its distribution throughout the human body, in almost every organ and tissue of which it has been proved to produce disease.

Indeed, as a recent writer remarks, "the contemplation of its activities and of its far-reaching influences and effects, really amounts to a revelation."

It may accordingly be of interest to briefly point out the ways in which the gonococcus may produce its pathogenic effects on the various tissues and organs attacked by it.

Its Portal of Invasion.—The portal of invasion in a gonococcal infection is by some mucous membrane—usually the urethral. In new-born children, the conjunctiva may be the mucous membrane which is affected, whilst in young girls, it may be the vulvo-vaginal mucosa. As the result of unnatural practices, the rectal and oral mucosa may become infected. More rarely aspiration of the maternal discharges by the new-born child may produce a purulent rhinitis, due to the gonococcus, whilst a case of Hocksinger's, in which arthritis developed in a new-born child as the result of an umbilical erosion, points to the possibility of gonorrhœal invasion from this source.

When deposited upon the urethral or other mucous membrane, the gonococcus penetrates the tissues, rapidly multiplies, and produces a purulent inflammation. Hence, in the majority of cases, purulent urethritis is the first symptom of gonorrhœal infection, though the possibility that, in some cases, a purulent urethritis may result from other causes should not be overlooked.

The Modes of Spread.—Complications may arise from dissemination of the gonococcus in two ways. In one, the dissemination occurs from direct extension of the primary infection along the mucous membrane to contiguous organs, both urinary and genital. In the urinary organs, cystitis, pyelonephritis, pyonephrosis, and renal and peri-renal abscess may result in this manner. In the male genital organs, the vas

deferens, epididymis, testis, prostate, and seminal vesicles may similarly be affected, and gonorrhœal peritonitis has resulted in the male, owing to contiguity of tissue between the peritoneum and the vas deferens and vesiculæ seminales.

Amongst the female genital organs to be thus affected, are the vulva, vagina, Bartholin's glands, Skene's tubules, the cervix, and body of the uterus, the Fallopian tubes and ovaries. Infection of the female peritoneum with the gonococcus has frequently been observed. Fortunately, the peritonitis is usually localised, of low virulence, and tends to recovery.

The second mode of dissemination is less widely recognised. It results from the entry of the gonococcus into the circulation, either directly or through the lymphatics, thus producing a systemic infection. A gonococcal septicæmia may thus result, producing serious and even fatal illness. Cardiac complications may result in the same manner, and cases of gonorrhœal endocarditis—both malignant and benign—and pericarditis have been recorded. Gonorrhœal arthritis and rheumatism are well recognised, and have been classified by König into :—(1) Hydrops gonorrhœicus ; (2) arthritis serofibrinosa et catanea ; (3) arthritis purulenta ; (4) arthritis phlegmonosa. Gonococcal pleurisy, myositis, phlebitis, bursitis, teno-synovitis occur less commonly. Bone lesions include cases of periostitis, periostoses, gonorrhœal flat foot, caries, osteomyelitis, and spinal arthropathy, in which the symptoms are impairment of movement, ankylosis and deformity of the spine, and sometimes the formation of osteophytes.

Eulenberg classifies gonorrhœal affections of the cerebro-spinal system into (1) neuralgic affections like sciatica ; (2) muscular atrophy and atrophic paresis ; and (3) neuritis and myelitis. Affections of the skin include papillary dermatitis with parakeratosis, ulcerations of the skin, and abscesses of the cutaneous and subcutaneous tissues. Ocular affections include purulent ophthalmia by direct infection, iritis, and irido-cyclitis by direct spread, as well as episcleritis, iritis, and irido-cyclitis due to systemic infection.

From this brief *résumé* of the pathogenic rôle of the gonococcus, it is obvious that this micro-organism is capable of producing the most far-reaching infections to which the human body is liable.

Preparations, Inventions, etc.

CELLULON (DIABETIC) BREAD.

(Messrs. Callard & Co., 74 Regent Street, London, W.)

We have received from Messrs Callard a brown loaf of diabetic bread, which contained nearly 50 per cent. of water, and was therefore pleasantly moist when it arrived, and remained so for some time. The carbohydrates, other than cellulose, were present in small quantity, less than 2·5 per cent., whereas there were 20 per cent. of proteins. When eaten with butter the taste was far from unpleasant, and we believe that persons suffering from Diabetes mellitus will be able to enjoy this Cellulon bread.

MALT EXTRACT BEER.

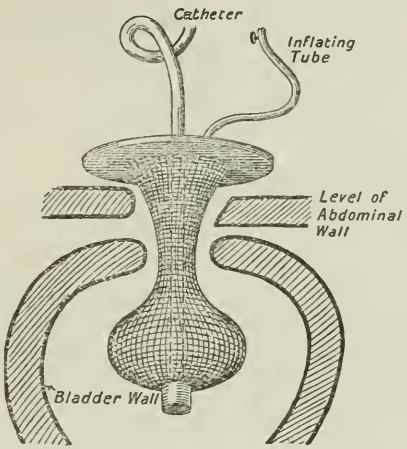
(The Stevns Breweries Company, Limited, Copenhagen, and 1 Walbrook, London, E.C.)

The flavour of this sample of beer sent to us for examination was fairly rich and distinctly malty. The beer contained a large proportion of malt extractives, whereas the amount of alcohol present was somewhat less than one per cent. Seeing that the beer contains this large percentage of malt extractives, it must obviously possess many nourishing qualities, and might with advantage be ordered for invalids as a bitter stomachic to be taken at meal times.

SELF-RETAINING "PLUGS" FOR SUPRA-PUBIC CYSTOTOMY.

Dr. J. H. Francis Nunn, of Upper Tooting, forwards to us specimens of india-rubber plugs, which he has devised for use in cases of suprapubic cystotomy, and which have been found to be of service in actual work. The idea is somewhat on the lines of a Barnes' bag, adapted for the special purpose, being of an hour-glass shape, inflatable, and with a central conduit for the catheter. The bag, uninflated and carrying the catheter in position, is introduced through the abdominal and bladder

incisions. It is then inflated with air, and so becomes self-retaining. Leakage from the bladder is prevented by the close adaptation of the air-inflated bag to the edges of the wounds,



so that the patient gains in comfort, and frequency in dressing is obviated.

The plugs were made by Messrs. Arnold and Sons, West Smithfield, according to Dr. Nunn's directions.

KUHN'S SUCTION MASK.

(Agents :—The Roborat Co., 8 Harp Lane, London, E.C.)

Since Professor Bies, then of Bonn, now of Berlin, introduced his treatment by artificially induced hyperæmia, no part or organ of the body seems to be safe from its application. The latest extension is to the lungs, and for the purpose a most ingenious mask has been devised by Dr. E. Kuhn, assistant in the First Medical Clinic of Royal Charité Hospital, Berlin, which is under the direction of Prof. von Leyden It has been tried on several patients in this clinic, and is now being used in many hospitals and sanatoria on the Continent and in this country. The mask is made of celluloid, with separate chambers for the mouth and nose, each of which opens by a sliding valve, and has also an expiratory valve. The part which comes in contact with the face is provided with an

air-pad. When applied, it is kept tightly in place by means of an elastic band passing behind the head under the ears. Kuhn claims that, by the use of his mask, a condition of pure hyperæmia can be obtained in the lungs by means of the impediment to inspiration, while expiration is quite free. Inspiration can only occur through the adjustable slit, which can be graduated to any desired degree. The use of the mask for about an hour twice a day has been proved to be sufficient for all therapeutic purposes.

The increased negative pressure in the thorax forces the diaphragm upwards, so that it takes very little part in respiration. This becomes costal, and gradually results in a considerable widening of the chest, especially of its upper part. With the hyperæmia the lymph-circulation is increased. There is no risk of hæmorrhage because the hyperæmia results, not from increased pressure within, but from suction on the vessels from without. The following results are claimed in the treatment of phthisis by the mask :—Improvement of respiration and dyspnœa, widening of the thorax, reduction of the frequency of respiration, cessation of cough and expectoration, increase in the red and white blood corpuscles and in the amount of hæmoglobin, strengthening of the muscles of respiration, and improved action of the heart. The apparatus is not complicated and is easily cleaned.

DUDGEON'S SPHYGMOGRAPH WITH TIME-MARKER.

Dr. L. N. Hesketh-Biggs sends us a Dudgeon's sphygmograph to which he has added a time-marker of his own invention. The latter consists of a small metal box with a rocking lever attached which may be readily fixed on to the top of the Dudgeon's sphygmograph by withdrawing the two top corner screws of the sphygmograph and then screwing the apparatus into position. This ingenious little instrument records one-tenth of a second, and such a time record will prove extremely useful where accuracy of timing pulse irregularities is needed. These instruments are made by Messrs. Horstmann, of Union Street, Bath.

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